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New Electric Truck Service Station of Commonwealth Edison Company, Chicago.

New Electric Truck Service Ready in Chicago

Commonwealth Edison Company Completes New Electric Service Station and Starts an Innovation by Rendering Complete Garage and Maintenance Service for Commercial Electric Vehicles

AN INNOVATION in the electric vehicle industry has been undertaken in Chicago by the Commonwealth Edison Company through the completion of an electric garage, in which commercial electric trucks will be given complete garage, charging and maintenance service, thus relieving the owners of these vehicles of substantially all costs aside from the first cost of the trucks, insurance and wages for the drivers. A general announcement of this new service was made by E. W. Lloyd, general contract agent of the company, last spring, and reported in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 2, 1917, since which time the first service station has been planned, erected and equipped so as to be ready for operation now.

Among the conditions that led to developing the new service are, on the one hand, increasing cost of horse feed and of fuel for gasoline trucks, growing scarcity of wagon drivers and skilled truck chauffeurs, together with increased cost and difficulty of getting gasoline trucks, due to army needs. On the other hand, conditions for the electric truck are comparatively favorable in that the cost of battery charging has not increased, electric truck driving is easily learned and drivers are not required to be skilled electricians or mechanics, when relieved of responsibility for maintenance and charging by a service such as this now offered. Moreover, the new service eliminates the uncertainties of battery upkeep and general maintenance formerly quite commonly associated with electric trucking due to lack of proper care. The Chicago conditions as to absence of hills, character of street pavements, and average length of hauls are also especially favorable to the electric. The winter season also, with its many falls of horses on icy streets, is favorable to the use of power wagons. All told, therefore, the time was deemed peculiarly opportune for undertaking the new service, which it is hoped will act as a marked stimulus to greatly extended employment of electric transportation in the city and as an object lesson to other communities.

PRINCIPAL FEATURES OF NEW SERVICE.

The primary idea of this new plan is to offer an electric truck service in which all transportation costs are guaranteed. The remarkable success attained by the many large fleets of electric trucks now in service fully demonstrates the superiority of the electric truck when cared for properly. The object of this service is to give to the individual user the advantage of such care.

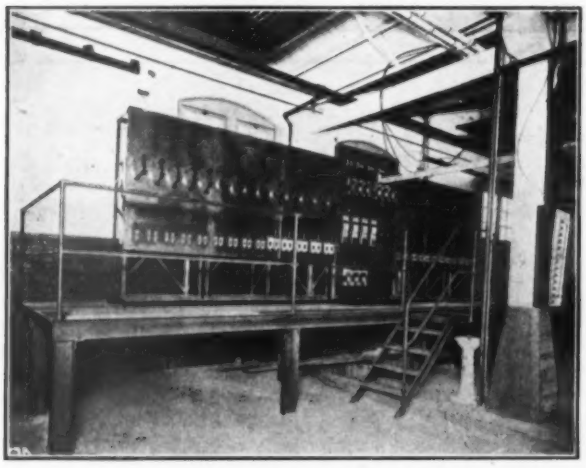
Only new electric trucks of standard type and equipment are to be given the benefits of the new service, since it is obviously impossible to guarantee all costs when the character of the previous upkeep is not exactly known. The service covers:

First, the ordinary garaging or storage, including the cleaning and care of the vehicles;

Second, the supply of energy for charging the batteries;

Third, the maintenance or upkeep of the wearing parts of the vehicles, including tires, batteries and mechanical parts.

This maintenance covers the ordinary upkeep and minor repairs of all kinds, as well as the removal of



Close View of One of the Charging Boards, from Photograph Taken Before Wiring Was Completed.

tires and batteries, when these repairs and renewals become necessary under normal wear and tear. It also includes painting of the body at specified intervals. There is included, of course, regular lubrication of all bearings, inspection, cleaning and other care of batteries, lamps, motors, controllers, brakes and all other running and wearing parts. In other words, it is proposed to keep the customer's vehicle in shipshape or the best possible condition, taking into consideration ordinary wear and tear, and to leave it practically like new, ordinary wear and tear excepted, at the end of the contract period, which is four years.

All of this service is to be rendered by a staff of attendants specially trained in the company's own electric garage, which adjoins the new garage just built for the new service. As to what is required in a service of this kind and the cost of rendering it also has been based on the company's own experience with electric vehicles extending over a period of nearly fifteen years and covering a fleet that has steadily increased until now it consists of 182 cars. The experience of other owners of large electric fleets, both in Chicago and elsewhere, has also been drawn on as to service requirements and costs.

Costs of Service.

The cost of the service is a flat rate payable monthly. This rate depends on the size and equipment of the truck, whether it has lead or nickel-iron batteries and the capacity of the batteries. This rate assumes a normal battery charge each working day. Should the truck be used for covering more than a normal distance daily so as to require additional charging, a special boosting charge, or use of an extra battery, the rate is increased accordingly. Boosting charges can also be obtained from several Commonwealth Edison substations in outlying districts. The rate depends directly upon the average service rendered and, being a fixed flat rate, enables the owner to know what his transportation will cost each year.

The only other cost elements not included in this rate are the driver's wages, the interest on the first cost of the vehicle, insurance, taxes and possible damage by accidents; with the exception of the latter, which may also be taken care of by accident insurance, these likewise are definite costs, so that the total cost is quite accurately known.

The New Truck-Service Station.

The foregoing general statement of the new electric truck service has pointed out most of its principal unique features. To these must be added that the service will be centered in a new building especially designed and erected for the purpose. It is situated at the northeast corner of Jackson Boulevard and Morgan Street; this favorable location is about a mile west of the city's business center, close to the principal trucking district west of the river, and easily accessible from all parts of the city. It is known as Service Station No. 1 and has a capacity of about 100 electric trucks or delivery vehicles. When this capacity proves inadequate it is expected to build an additional station north of it along Morgan Street, the company's own electric garage being between the two stations. Other service stations may be built on the south and north sides of the city if occasion demands.

A simple but substantial brick structure has been put up with outside dimensions of about 196 feet on Morgan Street and 125 feet 6 inches on Jackson Boulevard. As shown in the exterior view there are four large sliding doors in the west front. The square brick stack seen in the northwest corner of the building serves a Kewanee steam boiler for heating the building; this is in the basement located in this corner, where there is also a separate heater for furnishing hot water for washing. Over the corner of the building will be erected an attractive electric sign, which is contracted for but not yet delivered. This will permit removal of the temporary sign boards now on the corner.

The interior of the new building is divided by a brick wall with sliding fire door into approximately equal rooms. Each room is sectionalized into two parts by a row of columns in its center so that the four big Morgan Street doors give access for driving into these four separate sections. A toilet and wash room with adjoining steel lockers for the drivers is provided. The office of the service station is at the street corner in the southwestern part of the building.

A conspicuous feature is to be noted in the seven large plate-glass windows on the Jackson Boulevard front. These are intended for display purposes, the company placing the space along these windows at the disposal of manufacturers of commercial electric vehicles for exhibiting their various types. This will constitute a permanent central exhibition of electric trucks, changed from time to time to show new models. Along the upper edge of each large window are placed eight 100-watt type C Mazda lamps in mirrored-glass window reflectors for effectively illuminating the vehicles displayed. On account of the heavy automobile traffic along the boulevard, this truck-display feature will doubtless attract considerable attention both by day and by night.

Charging Facilities.

Many features of the battery-charging equipment of the station are of unusual interest, among these being the certainty of direct-current supply from two sources, the simplicity of the charging control board, the provision for a recording meter for each circuit, and the arrangement of the charging circuit terminals and connections. Direct-current energy supply is

received by two independent 230-115-volt three-wire cables from two separate sources, one being the West Side network of the Commonwealth Edison system, the other the Morgan Street substation. These connect to the central panel of the control board in each room, which is located between the two big doors on the Morgan Street side.

On the central panel of each board these supply cables terminate in triple-pole 1500-ampere switches. After passing through a totalizing watt-hour meter and test loops, connection is made to the buses. In the south room there are at present 26 charging circuits and in the north room 32. Each circuit has its own control equipment, four or five circuits being grouped on each of the side panels. The control apparatus for each circuit includes a double-pole switch and an iron-grid rheostat with special ammeter switch. At each end of the board is a swinging panel with an ammeter and a voltmeter.

The arrangement of each charging circuit is as follows: The double-pole switch connects the circuit to the buses, alternate panels being connected to opposite sides of the system. For most of the circuits these switches are of 100-ampere size, but for five circuits in each room they are of 200-ampere size; these heavier circuits are intended for use in boosting at heavy rates or for charging the largest trucks. One side of the circuit passes through the rheostat, which consists of iron-grid resistors mounted on back of the board. The movable rheostat arm is for adjusting the resistance and therefore the current in the circuit to that suited for the size and condition of the particular battery being charged. What looks like a second rheostat arm in the upper part of the rheostat is really a special ammeter switch. By pressing this the circuit is connected to a special set of ammeter buses, which include an ammeter shunt, from the terminals of which connection is made to the ammeter on the instrument panel at the end of the board. With one hand the operator adjusts the current by means of the adjusting arm of the rheostat and with the other he presses the switch, so that he can see on the ammeter just what current is being used. On releasing his hold on the switch arm the ammeter is automatically cut out of circuit. At the top of the panel is a double-pole cricuit-breaker for each charging circuit. The boards are mounted on slate-floor platforms raised several feet over the concrete floor of the rooms. The charging panels of the board and special rheostats were furnished by the Schaefer Brothers Company, Chicago.

From the charging board the circuits lead in conduits, run overhead to points on the ceiling directly over each charging outlet. In the north room the charging outlets are arranged along the north and south walls and on the north and south sides of each column in the center of the room, thus providing for eight charging outlets on either side of the center aisle opposite the entrance doors. In the south room a similar arrangement is followed except that there are now no charging outlets along the large display windows on the Jackson Boulevard front. The conduit from the charging board terminates in a special junction or terminal box over each outlet. In this, connection is made to a flexible cable hanging loosely from the box, the cable being securely anchored in the box. At a height of about five feet from the floor this cable terminates in a special double-pole connecting receptacle from which a short, flexible jumper is connected to the charging vehicle. This arrangement is to prevent accidents caused by a driver starting up his truck while the same is connected to the charging circuit. It has been found that cases of this kind occurred in which the driver started up his car and the cable was in such a position that the plug could not readily pull out of the connecting receptable, the result being that the wall receptacle and circuit were torn from their supports. This caused a ruling to be made in Chicago, requiring a separable receptacle such as that referred to. Since the cable is loose and flexibly supported from the box at the ceiling, if the driver should start up without disconnecting the cable, there would be a strong longitudinal pull upon this flexible cable, which would cause the special receptacle to open up. On the short jumper between this receptacle and the car the connecting plugs are of standard type. All of the charging plugs and receptacles were furnished by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.; the special receptacles of the separable type are known as type A B C.

Facilities for Washing Trucks.

Special facilities are provided for conveniently washing all trucks at regular intervals, or when needed. At the east end of each aisle is a patented universal swiveling washing rig mounted on the ceiling, so as to easily clear any truck. It is connected with both hot and cold-water piping on the wall, through a mixing valve. In the center of the outfit is a special valve directly below which the hose is connected. The hose is supported on an arm, which can be swung around in a complete circle. This special valve is arranged so that it is operated by pulling on the hose in a manner similar to a pull socket; one pull on the hose starts the flow of water, the next pull stops the flow. The entire arrangement is very convenient, it enables every part of the vehicle to be reached easily, keeps the hose off the floor and thereby reduces wear and tear of hose, it makes washing much easier for the men and it saves considerable water, which is an especially important matter in winter, when it is necessary to use warm water. The special water-control device was invented by C. C. McMahon, assistant superintendent of the Service Station and of the Edison company's own garage adjoining.

Interior of South Room of Service Station, Looking West. This Shows Only About Half of This Room.

The floor is of concrete throughout the station and slopes to numerous drains provided in the center of each aisle. Separate hose connections are provided for thoroughly flushing the entire floor, or for minor washing on the trucks.

Battery-Maintenance Equipment.

It was pointed out in the introduction that battery maintenance is contemplated in the new service. This includes periodic washing of the cells to remove sludge deposits, as well as renewal of plates, separators and jars as needed. Of course, the regular addition of water to replace that lost by evaporation, as well as

Cover Design of Circular Announcing the New Service.

adjustment of electrolyte is provided. In the Edison company's garage, just north of the Service Station, there is a battery room for taking care of this special maintenance and this will be used until a larger room is needed. In this battery room there are facilities for taking care of all the battery needs referred to, as well as special charging circuits whereby any battery or even any individual cell may be given a charge at almost any rate. A small panel is specially provided for this charging. A feature of the equipment is a special apparatus for treating the caustic potash used for Edison batteries. On account of the high cost of potash it has been found advantageous to treat the electrolyte for removal of carbonates or other impurities, rather than throwing it away and putting in fresh potash solution. On the second floor apparatus is provided for furnishing pure distilled water. It consists of a water still discharging into a 250-gallon tin-lined storage tank. From this tank the distilled water is distributed through tin-lined pipes to convenient points on the first floor of the garage. Provision is made for testing the electrotype, both for density and purity. A suitable stock of battery plates, separators and jars is carried.

Lighting Equipment.

The station is exceptionally well lighted throughout. The numerous windows and the large skylights give abundant daylight. For general illumination at night there are provided in each room 48 single-unit ceiling fixtures, consisting of an enameled steel reflector and 100-watt type C Mazda lamp. These are well distributed, so as to give a very good light distribution over the entire floor. Ordinarily they provide all of the illumination needed. For special inspection or trouble finding, a large number of special outlets are provided, both on the walls and columns. These consist of Hubbell porcelain wall receptacles; they are connected to a separate conduit system from that supplying the ceiling lights. The special window lighting on the Jackson Boulevard front has already been referred to. It also is connected to a separate conduit system. Above each of the entrance doors, on Morgan Street, there is a 500-watt lamp inclosed in an opal acorn-shaped globe. These also are on a separate conduit system. The large electric sign to be placed on the corner will also be separately controlled. For each of these separate lighting systems there is provided a special switch in the upper part of the center panel on the switchboard in each room. A separate panelboard is provided for the ceiling and wall-receptacle circuits. This is on the column nearest to the charging board, so that the operator stationed there can readily control it also.

A fire-alarm system with numerous stations has also been installed in the new garage. It is connected by conduit to a central point. The building is heated throughout by steam, coils being placed mostly on the ceiling, also on the east wall and special radiators being mounted between the windows on the Jackson Boulevard front. The office of the station is arranged for the keeping of records, as well as to enable prospective customers to find a quiet central point, where the service can be explained and merits of electric-trucking pointed out.

Conclusion.

While the new station is designed primarily for the special truck service already described, the facilities will also be placed at the disposal of owners of pleasure electric cars or commercial vehicles who wish to have a special charge at any time of the day. It is intended at first to also undertake a limited amount of general garaging of electric trucks for such owners as wish to become familiar with the service rendered on the regular plan by actual trial before a four-year contract is entered into.

It may be pointed out in conclusion that this new electric truck service is something of an innovation for a central-station company to undertake. It is much more comprehensive than the battery-rental systems undertaken by some companies in the East, and it is believed that when the economy and other merits of the plan are fully understood, it will prove a popular service for the owners of electric commercial vehicles in Chicago.

Washington Engineers Elect Officers.—At a meeting of the Washington (D. C.) Chapter of the American Association of Engineers, held in that city, Friday evening, December 14, the following were elected officers of the Washington Chapter: F. R. Weller, consulting engineer, president; A. S. Grossberg, chief designer, Bureau of Yards and Docks, first vice-president; Harry Stevens, consulting engineer, second vice-president; Capt. D. S. Hays, Engineer Corps, U. S. A., secretary and O. M. Sutherland, mechanical engineer, Bureau of Yards and Docks, treasurer. The chapter has 100 members and is a member of the Chamber of Commerce of the United States of America and is co-operating with all the Chambers of Commerce throughout the country.

Electrical Cooking as Applied to Large Kitchens

Descriptions of Four Installations in Newcastle, England, With Costs, Results Obtained and Advantages, Abstracted from Paper Before Institution of Electrical Engineers

By W. A. GILLOTT.

OWING to the favorable tariffs now in force in most districts, electrical cooking in large kitchens is now a sound commercial proposition. In new premises, where it is proposed to run the kitchens on up-to-date and efficient lines, electricity is usually employed. The author means the words "large kitchens" to apply more particularly to the class of kitchen met with in restaurants and in works or other large business premises when staff-feeding is required for a large number of employees. In Newcastle-upon-Tyne there are several such institutions depending entirely upon electricity for cooking.

The author considers the future of this branch of electrical industry to depend, first, upon close cooperation between the supply company's engineer and the manufacturer, and second, upon the interchange of ideas and experiences between different supply companies and municipal engineers who have the plant actually running on their own mains. This paper has therefore been prepared in the hope that the facts and illustrations given may be of use to others who are engaged upon or are considering similar work; also to show that electrical cooking is not only extensively used in large kitchens, but also found to be reliable, efficient, and economical. The figures given have been obtained under ordinary working conditions, and in some cases without the knowledge of the cook using the apparatus. They can therefore be taken as a basis for similar installations working under somewhat similar conditions.

Essential Elements for Successful Large Electric Kitchens.

In drawing up a scheme for cooking in large kitchens, the essential items are:

(1) Reliability;
(2) Quick service;
(3) Efficiency.

Reliability.—Under this item the question of electrical distribution from the service cables is as important as the electrical work on the apparatus itself. This is more so at a restaurant where there are serveries on different floors, quite apart from the kitchen, than in an establishment where staff-feeding is only required with the kitchen adjacent to the dining rooms. In the latter case a cable from the service to the distributing center in or near the kitchen is all that is required; but in the former case, especially where the total loading of the apparatus in the serveries is appreciable, two pairs of cables should be brought from the service, which on large installations should be the main distributing center, to each servery and kitchen. This system, in the author's opinion, is better than balancing one servery or kitchen against the other, as in the event of a fault developing on the mains only a section of the apparatus will be put out of commission.

In each kitchen or servery these cables should terminate in a double-pole switch of ample size and single-pole fuses of the replaceable pattern, and connections be provided to supply through branch single-pole fuses to the various pieces of apparatus, each of which should be controlled by a double-pole switch adjacent to the same. It may be argued by some engineers that to place a piece of apparatus on a separate circuit with its own switch and fuses is an extravagance, but the author is strongly of the opinion that it leads to economy by securing reliability, inasmuch as if a fuse blows only one piece of apparatus is affected.

The apparatus itself must be of solid construction and designed to stand hard and continuous wear, and be efficiently earthed. All switches and fuses must be fixed on a separate board within easy reach of the chef, and each section of the apparatus should be fitted with a switch, fuse, and indicator. The internal wiring of the apparatus must be so fitted that it is practically impossible for steam to penetrate through to the insulation.

All elements except the grills should be connected

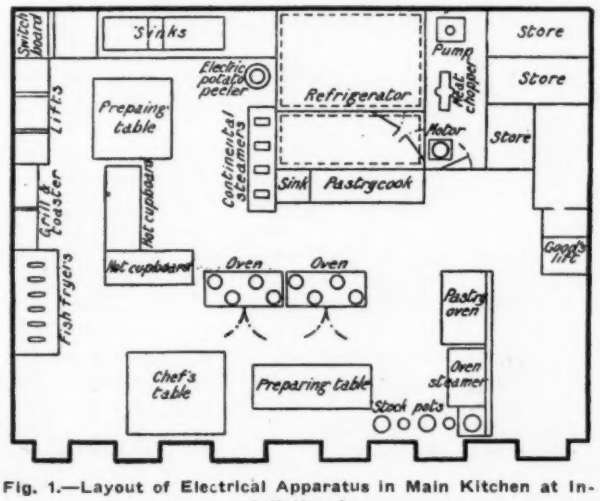


Fig. 1.—Layout of Electrical Apparatus in Main Kitchen at Installation A.

in series-parallel, and where possible they should be so arranged that after the cooking has thoroughly commenced, they can be switched to "low" and provide sufficient heat to complete the operation. Under these conditions the elements are running at quarter load during the majority of the time, with the result that the elements have a much longer life than if parallel elements were employed throughout.

Quick Service and Efficiency.—These two items, so

far as the chef is concerned, come under one heading and can therefore be dealt with together.

In laying out a cooking scheme for a large kitchen, it is essential to arrange the apparatus so that the chef can supervise the cooking with a minimum of effort. By a judicial classification of apparatus, such as grouping all roasting and oven work in one section, vegetables and pudding steaming, etc., in another, and toasting, egg-poaching and tea-making in another, it is possible considerably to increase the efficiency of the kitchen, inasmuch as quicker service is given and a possibly smaller kitchen staff required. In restaurant work, where special attention must be given to insure quick service, it is often necessary to provide special apparatus to deal with some classes of food which are required at a moment's notice.

Where large quantities of water are required for tea-making, etc., the author recommends that the water be raised to a temperature of approximately 160 degrees Fahrenheit by means of a coke boiler or live steam, the final boiling being carried out in self-contained electric urns, the sizes of the urns, of course, being suited to the demand. The author usually fixes urns in banks of two, each supplied with hot water through a hand-fed valve, and arranged so that as one is being emptied, the other is boiling up ready for use. By this method, one is always in a position to meet a "rush on teas." In some cafes, toast is often in great demand. By using suitable racks, several pieces of bread can be toasted at one time. At one installation, *A*, 2000 pieces of toast can be supplied in one hour.

Plate and dish-warming is a very necessary item, especially in restaurants where ample accommodation is essential. This becomes very important in installations such as *A* below, where dining rooms are on several floors. Hot cupboards for this class of work should be lagged, as they are called upon to work several hours a day, and, by conserving the heat, running costs are kept down. The question of keeping food hot is also a very important item, and in restaurants this has to be carried out in an entirely different manner from that adopted in staff-feeding establishments, where the meals are usually provided at a specified time each day.

When specifying the essential items in large-kitchen practice, it will be observed that efficiency was placed third. It is not suggested that electrical efficiency should be disregarded altogether, but the author is convinced that the "man who pays the bill" would prefer to pay a little more for energy, knowing that he was getting this returned in reliability. It would be a serious thing, for instance, if a restaurant or staff kitchen were half an hour late with a meal owing to a breakdown caused by endeavoring to extract the highest possible efficiency from a piece of apparatus at the expense of reliability.

Upon referring to the schedules of installations, it will be noticed that the number of hot plates has been kept low, and several pieces of self-contained apparatus have been provided. This is more practical than cooking in utensils on hot plates. This may be objected to owing to the increased initial cost, but it is money well spent, and the policy should be adopted wherever possible. Where hot plates are used, the loading should not exceed 20 watts per square inch of an eight-inch plate.

Details of Typical Installations.

The following schedules contain particulars of some of the installations equipped in Newcastle, and give sufficient evidence that satisfactory results are being achieved on this class of work.

In giving details of these installations, the author does not wish to convey the idea that every restaurant or staff-feeding establishment should be supplied with the same pieces as those specified. As is well known, every establishment has its own special condition, and each has to be dealt with accordingly: for instance, at installation *A* the menu is of very varied nature, but at installations *B* and *C* the menu is only slightly varied to suit the different classes of persons catered for. If we take the case of a workhouse or an asylum, where large quantities of one class of food are required, larger pieces of apparatus would be installed, and owing to the less variety in the menu, a smaller number of pieces of apparatus would be supplied.

Installation A (See Fig. 1). Connected September, 1916. Class—Restaurant.

Main Kitchen.

Baker's Oven.—One piece. Made up in heavy-gauge cast iron. Sides, back and top lagged with 3 inches of slag wool. Two decks, measuring 38 by 40 by 8 inches and 14 inches respectively, heated by crown and sole elements, split into 12 sections and arranged for three-heat control on each section by series-parallel switches. Interior of ovens lined with tiles. Load.....15 kw.

Two Double-Oven Ranges.—Two ovens under one hot plate, each oven measuring approximately 22 by 22 by 26 inches, and arranged for three-heat control. Hot plate fitted with two 10-inch and two 8-inch boiling rings, each with three-heat control. Ovens well lagged with slag wool, the whole outfit made up in heavy-gauge cast iron. All wiring carried outside of range, with provision for easy inspection and renewals. Load of each range.....17.5 kw.

Hot Cupboard.—Made up in cast iron and mild steel. Sides lagged with asbestos. Cupboard measuring 6 feet 6 inches by 2 feet by 2 feet 7 inches; top plate of cupboard plain, heated separately from interior, each section arranged for three-heat control. Sliding doors on one long side. Load.....6 kw.

Hot Cupboard.—Same as above, but fitted with sliding doors on both sides. Load.....6 kw.

Fish Range.—Six oval fryers, each measuring 22½ by 15 inches, and loaded to 3 kilowatts and arranged for three-heat regulation. Fryers mounted on cast-iron table, with high back skirting with drip pans over each fryer. Canopy is fixed over the whole set. Load.....18 kw.

Continental Type Steamers.—One range of four pans each measuring 17 by 12 by 12 inches, made up in mild steel and loaded to 3 kilowatts each, and arranged for three-heat regulation, each containing one block-tin steamer, all mounted on cast-iron stand and provided with drip gutter. Load....12 kw.

Two Grills and Toasters.—Combination grill and toaster fitted in tiers one above the other, bottom grill with fat drawer, center toaster, top hot cupboard, each unit loaded to 4 kw. All made in cast iron with porcelain enamel interiors. Load of each.....8 kw.

Egg Poacher.—One poacher with 6 insets to take 12 eggs. Case made in heavy copper, nickel plated. Three-heat regulation. Load.....2.2 kw.

Egg Poacher.—Same as above, but for 6 eggs and loaded to.....1.5 kw.

Café Servery.

Hot Cupboard.—One 5 feet by 2 feet 6 inches by 2 feet cupboard fitted with sliding doors. Cupboard loaded to 3 kilowatts with three-heat regulation. Top fitted with four 8-inch hot-plates, each loaded to 1.1 kilowatts and arranged for three-heat regulation. Total load.....7.4 kw.

Grill and Toaster.—One combination grill and toaster as in main kitchen. Load.....8 kw.

Two Water Urns.—Ten-gallon urn in copper, nickel-plated with flat lids (to accommodate cups, etc.), loaded to 6 kilowatts with seven-heat regulation, supplied complete with gauge glass and thermometer. Urns fed with water at 150° F. through hand-fed valve. Load of each.....6 kw.

Café-au-Lait.—One three-jar suite, each jar of five pints capacity, fitted with water bath. Jars sunk in wells. Made in heavy copper, nickel-plated, loaded to 3 kilowatts with three-heat regulation. Load.....3 kw.

Egg Poacher.—One for 12 eggs, as in main kitchen. Load.....2.2 kw.

Egg Poacher.—One for 6 eggs, as in main kitchen. Load.....1.5 kw

Smoke-Room Servery.

Hot Cupboard.—One special type measuring 7 feet 3 inches by 2 feet 6 inches by 2 feet, fitted complete with two Continental-type steamers (as in main kitchen) two 8-inch hot plates and warmed top. Cupboard loaded to 3 kilowatts top, 1.5 kilowatts; steamers, 2 kilowatts each, hot plates, 1.1 kilowatts each; all arranged for three-heat regulation. Sides of cupboard lagged. Load.....10.7 kw.

Hot Cupboard.—One measuring 6 feet by 2 feet 6 inches by 2 feet fitted with three carving wells and overhead gear, and one Bain Marie. Cupboard loaded to 3 kilowatts and heated separately from carving wells, which are loaded to 2 kilowatts and Bain Marie to 1.5 kilowatts; all with three-heat regulation. Sides of cupboard lagged. Load.....6.5 kw.

Two Grills and Toasters.—Combination, as in main kitchen. Load of each.....8 kw.

Two Water Urns.—Ten-gallon, as in café servery. Load, each.....6 kw.

Café-au-Lait.—One as in café servery. Load..... .3 kw.

Warming Cabinet.—One cabinet in two tiers, arranged with top heat for keeping savories hot. Each unit loaded to 1.5 kilowatts arranged for three-heat regulation. Suite made up in cast iron, all nickel-plate. Load.....3 kw.

Two Fish Fryers.—Made up of cast iron, similar to main kitchen, but measuring 15½ inches by 8 inches, loaded to 2 kilowatts with three-heat regulation. Load, each.....2 kw.

Egg Poacher.—Poacher for 12 eggs. Load.....2.2 kw.

Egg Poacher.—Poacher for 6 eggs. Load.....1.5 kw.

Dining-Room Servery.

Hot Cupboard.—One special type, as in smoke room. Load .....10.7 kw.

Hot Cupboard.—One 6 feet with carving wells, as in smoke room. Load.....6.5 kw.

Toaster.—One toaster measuring 24 inches by 10 inches (toasting space) fitted with hot cupboard oven. Outfit made in cast iron and nickel-plated, with white porcelain interior. Heat unit split in half and arranged for two-heat regulation. Load .....4 kw.

Two Water Urns.—As in smoke room. Load, each..6 kw.

Café-au-Lait.—As in smoke room. Load.....3 kw.

Egg Poacher.—Poacher for 12 eggs. Load.....2.2 kw.

Egg Poacher.—Poacher for 6 eggs. Load.....1.5 kw.

Warming Cabinet.—One as in smoke room. Load...3 kw.

TOTAL loading of whole equipment.....247.6 kw.

Installation B. Connected August, 1915. Class—Staff-Feeding.

Kitchen.

Roasting Oven.—One cabinet-type, measuring internally 2 feet 9 inches by 2 feet 4 inches by 4 feet 4 inches, loaded to 15 kilowatts with two sets of elements on each side and back, arranged for six-heat regulation. Outfit made up in heavy-grade cast iron with sides well lagged with 2 inches of slag wool. Large fat drawer fitted at bottom, shielded from heat by drip pan. Load.....15 kw.

Oven Range.—One treble-oven range with two ovens measuring 22 inches by 22 inches by 26 inches, loaded to 5 kilowatts with three-heat regulation, and one pastry oven of two-deck type, loaded to 4 kilowatts, each deck measuring 22 by 22 by 13 inches. Range fitted with two 12-inch, two 10-inch, two 8-inch and one 6-inch hot plates, all arranged for three-heat regulation. Whole outfit made up in heavy-gauge cast iron, and ovens well lagged with slag wool. Load....24.9 kw.

Vegetable Steamer.—One double steaming oven in heavy-gauge cast iron, each oven containing 5 galvanized-iron trays, each capable of holding 28 pounds of potatoes (or equivalent in puddings, etc.), water-fed automatically by means of ball-valve cistern. Each oven loaded to 5 kw. and arranged for three-heat regulation. Load.....10 kw.

Water and Coffee Urns.—Three 10-gallon water urns, in copper, each loaded to 5 kilowatts and arranged for three-heat regulation. One 10-gallon coffee urn, in copper, with earthenware interior, loaded to 3 kilowatts. The four urns fitted on galvanized cast-iron stand, fitted with rubber buffers and drip drain. Load.....18 kw.

Stock Pots and Soup Boiler.—Four 10-gallon copper pans, each loaded to 3 kilowatts with three-heat regulation, fitted on galvanized cast-iron stand as above. Load.....12 kw.

Fish Range.—Four fish fryers, two measuring 22½ by 13 inches loaded to 3 kilowatts each, and two measuring 15 by 10 inches, loaded to 2 kilowatts each, all arranged for three-heat regulation. Fryer made up in cast iron, and fixed on planished table, measuring 4 feet 10 inches by 2 feet 6 inches by 2 feet 10 inches. Load.....10 kw.

Grills.—One suite made up of two-tier grill, measuring 30 by 10 inches, each loaded to 5 kilowatts and arranged for two-heat regulation, i. e. in halves. Made up in cast iron and fixed on brackets to the wall. Load.....10 kw.

Hot Cupboard.—One cupboard, measuring 6 feet by 2 feet 6 inches by 2 feet 8 inches, top containing three carving wells. Cupboard loaded to 3.5 kilowatts and top to 2.5 kilowatts. Each arranged for three-heat regulation. Load.....6 kw.

Water Urn.—One quick-boiling urn, in copper, of one-gallon capacity, for kitchen-staff purposes. Three-heat regulation. Load .....2 kw.

Two Egg Poachers.—Each poacher in heavy copper, with three insets, each with a capacity of two eggs, i. e. six in all. Load, each.....1.5 kw.

Servery 1.

Hot Cupboard.—One cupboard measuring 3 feet by 2 feet 3 inches by 2 feet 9 inches, fitted with two carving wells. Cupboard loaded to 2.5 kilowatts and top to 1.5 kilowatts; each arranged for three-heat regulation. Outfit made up in cast iron. Load.....4 kw.

Servery 2.

Hot Cupboard.—Same as above. Load.....4 kw.

Servery 3.

Hot Cupboard.—Measuring 5 feet by 2 feet 3 inches by 2 feet 9 inches, fitted with three carving wells and two sauce pots. Cupboard loaded to 3.5 kilowatts and top to 2.5 kilowatts; each arranged for three-heat regulation. Outfit made up in cast iron. Load.....6 kw.

Servery 4.

Hot Cupboard.—Same as for Servery 3. Load.....6 kw.

TOTAL loading of kitchen equipment.....130.9 kw.

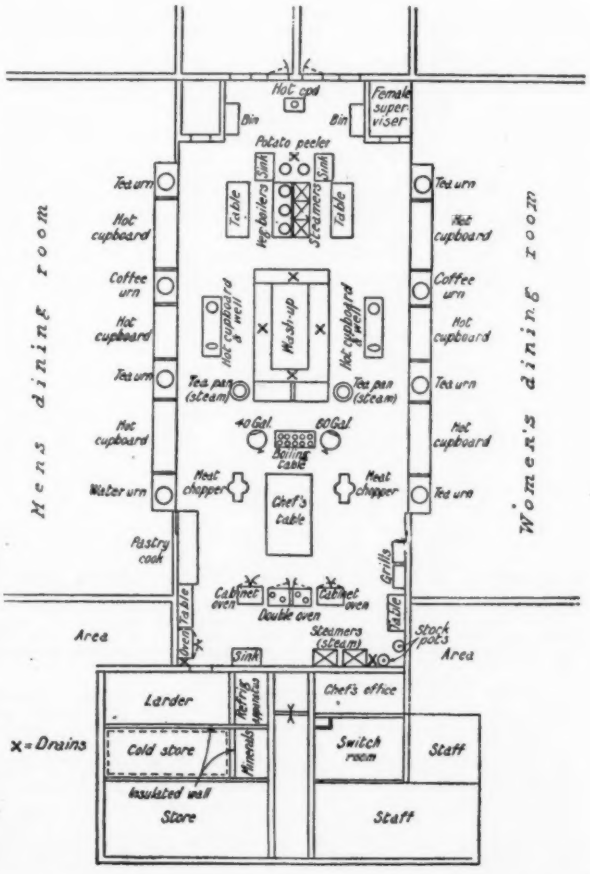


Fig. 2.—Plan of Canteen Kitchen Cooking Arrangements and Layout Designed by the Author.

Installation C. Connected June, 1914. Class—Staff-Feeding.

Double-Oven Range.—Each oven measuring 24 by 22 by 26 inches and loaded to 5.5 kilowatts. Over the oven on a hob plate are fitted one 12-inch, one 10-inch and four 8-inch hot plates and a grill 18 by 10 inches. All except grill, arranged for three-heat regulation Load.....23 kw.

Vegetable Boiler.—One four-gallon boiling pan complete with three block-tin steamers. Pan loaded to 3 kilowatts and arranged for three-heat regulation. Load.....3 kw.

Water Urn.—One four-gallon copper urn arranged for three-heat regulation. Load.....3 kw.

Grill.—One 24 by 12-inch grill arranged for two-heat regulation (in halves). Load.....4 kw.

Hot Cupboard.—One 3-foot cupboard, made in mild steel with lagged sides. Cupboard loaded 2 kilowatts. Top has two carving wells and loaded 1.5 kilowatts. Both arranged for three-heat regulation. Load.....3.5 kw.

Carving Table.—One 5-foot 6-inch table with two carving wells and two vegetable pots, each holding 28 pounds of vegetables. Pots stand in water bath which is loaded to 2 kilowatts. Carving top loaded 2 kilowatts. Arranged for separate control and three-heat regulation. Load.....4 kw.

TOTAL loading of whole outfit.....40.5 kw.

Installation D. Connected March, 1915. Class—Staff-Feeding.

Double-Oven Range.—Each oven measuring 18 by 18 by 14 inches and loaded to 3 kilowatts, with hob plate over ovens containing two 10-inch, three 8-inch and one 6-inch hot plates. All arranged for three-heat regulation. Outfit made up of heavy-gauge cast iron and ovens well lagged with slag wool. Load.....13.3 kw.

Boiler.—One 12-gallon heavy-gauge copper boiling pan for vegetables, etc., complete with two block-tin steamers, arranged for seven regulations of heat. Load.....6 kw.

Steamer.—One cabinet-type pudding steamer, measuring 12 by 12 by 12 inches inside, made up in cast iron, and supplied with an automatic supply of water through ball-valve cistern. Arranged for three-heat regulation. Load.....2 kw.

Grill.—One grill measuring 24 by 10 inches, with three-heat regulation. Made up in cast iron and stands on four 6-inch legs. Load.....4 kw.

Fish Fryers.—One oval fish fryer, measuring 15 by 10 inches, with three-heat regulation. Made up in cast iron. Load.....2 kw.

Water Urn.—One four-gallon urn, in copper, with three-heat regulation. Load.....3 kw.

Hot Cupboard.—One cupboard measuring 3 feet by 2 feet 9 inches by 1 foot 10 inches, with three-heat regulation. Outfit made up in cast iron with mild-steel sliding doors. Load..2.5 kw.

TOTAL loading of whole equipment.....32.8 kw.

The following table shows the details of consumption, cost of maintenance, etc., on the installations referred to.

Installation.	Period of Observation.	Consumption in Kw.-hours.	Avge. number of meals per week. Breakfasts.	Lunches.	Teas.	Total.	Cost of Maintenance per 1000 kwh. consumed
A	10 mo.	122,052	389	5,186	3,943	9,518	$0.37
B	1 year	97,140	204	1,480	1,260	2,944	0.66
C	1 year	21,141	211	452	328	991	0.91
D	1 year	20,690	48	371	221	640	1.09

REMARKS.

A.—In addition to the figures of meals, there is a weekly average of 600 Bovrils and hot drinks. The list of the quantity of food cooked is a weekly average. From tests taken, the consumption of energy per person served, including staff, is 0.29 kwh. per meal.

B.—The list of the quantity of food cooked and consumed on an average day gives a good indication of the nature of the work performed. There are, however, several items carried out by the apparatus which do not come under the heading of cooking for the staff. The estimated consumption of electricity per person is 0.5 kwh. per meal.

C.—No list of food cooked has been obtained from this installation, but the consumption of electricity per person per meal is found by taking various tests to be 0.41 kwh.

D.—In addition to the number of meals provided, there is a weekly average of 106 Bovrils and hot milks, and 50 lbs. of bread baked and 9 suppers. There are also occasions when large quantities of food are cooked and consumed at other places, a list of which is given. From various tests carried out, the consumption of electricity per person catered for is 0.51 kwh. The cost of maintenance on this installation is high in comparison with the others; this, however, is due to the fact that during the last 18 months the apparatus has been catering for an increase of 100 per cent more people than originally intended.

In conjunction with these figures, one must also consider the advantages of electrical cooking from the economy of labor and food, simplicity of operation, the less fire risk, the saving on utensils, cleanliness, and the less floor space required as compared with coal, gas, or steam.

In the analysis, all elements, etc., that have been supplied free under guarantee have been included at their ordinary costs, workmen's train fares have been omitted in order to make a true comparison with those installations close to the workshop.

Maintenance Analysis of Installations A, B, C, and D.

Installation.	Oven.	Hot-plate.	Grill.	Urn.	Hot Cupboard.	Fish Fryer.	Vegetable Steamer.	Wiring Faults.	Earthing Faults, Terminals, etc.
A	4	2	7	..	..	..	..	17	4
B	20	16	25	5	2	3	7	27	25
C	..	22	1	1	..	..	..	14	..
B	2	28	28	..	..	..	..	17	..

Average quantity of food cooked and consumed at installation A *per week:*

1362 lbs. roast meat.
140 birds (average weight 3 lbs. each).
282 grills.
300 lbs. sausages.
35 gals. soup.
2162 portions of fish.
140 lbs. Yorkshire pudding.
2940 lbs. potatoes.
10½ pecks of peas.
63 cabbages.
84 lbs. turnips.
56 lbs. carrots.
56 lbs. milk pudding (in dry state).
854 portions of ham and eggs on toast.
1150 cups coffee.
915 gals. water boiled from 150° F.
1265 portions hot sweets.
112 lbs. scones.
42 lbs. pastry.

Average quantity of food cooked and consumed at installation B *per day:*

79¼ lbs. roast beef.
34 lbs. haricot mutton.
10 gals. potato soup.
21 lbs. peas boiled.
10 lbs. beans boiled.
112 lbs. potatoes.
½ gal. vegetable stock.
6 gals. milk pudding.
1 gal. hot milk.
2 hams boiled (28 lbs).
80 eggs fried and poached
1 side bacon (grilled and fried).
100 gals. water boiled from cold.
22 lbs. chops grilled.
67 slices toast.
10 gals. coffee.
2 lbs. Quaker oats.

Average *monthly* list of food prepared on the apparatus at installation D and consumed at other places:

218 lbs. boiled beef.
98 lbs. roast beef.
77 lbs. boiled ham.
230 lbs. bread.
16 lbs. cake.
50 gals. water boiled from cold.
50 teas.
21 lbs. beetroot.

Comparative Initial Costs.

A comparison of the initial costs of installations *A* and *B* with electrical apparatus, gas apparatus, and a mixture of coal, gas, and steam apparatus, is given in the following table (the cost of connecting up the apparatus to the source of supply is in each case included):

Installation.	Electricity.	Gas.	Coal, Gas, and Steam.
A	$7032.18	$5681.34	$6196.50
B	2752.22	2371.68	2604.96
C	527.80	478.71	.....
D	542.50	507.38	.....

In the case of gas apparatus, the warming cabinets and portable fish fryers in installation *A* have been omitted, as it was impossible to obtain prices for them. It is doubtful, however, if they could be supplied for gas heating.

In the case of the coal, gas, and steam apparatus at the same installation, oven roasting, pastry baking, and grilling would be carried out by coal or coke (with the exception of the grills in the serveries, which would be done by gas); the hot cupboards and steamers by steam, and the remainder of the apparatus would be heated by gas.

On installation *B*, under coal, gas, and steam apparatus, coal or coke would be used for the treble-oven range and grilling, gas for the cabinet roaster and fish fryers, and the remainder of the apparatus would be heated by steam.

In comparing the initial costs of these installations heated by different agencies, one must not overlook the fact that the manufacturer of electrical apparatus has not the advantages of the manufacturer of either

coal, gas, or steam apparatus, inasmuch as the demand for electrical apparatus is very small compared with the others; his patterns are new and the skilled labor more costly.

The difference in the initial cost is not so much with an installation of coal, gas, and steam, as with gas alone, but it would be impossible to use gas apparatus only on installation *A*, for instance, owing to the restricted space. The first cost is not the only cost to be considered, and should never be looked upon as the prominent factor.

Advantages of Electric Kitchens.

When the working comparisons are considered, electricity has the advantage in almost every detail, the following being a few of the essential items which in the majority of cases when carefully gone into offer sufficient advantages to outweigh any difference in capital cost:

(1) Cleanliness and absence of fumes, as against the fumes where gas is used, and the soot and smoke with coal and steam (from boiler).

(2) Constant heating value, also the facility of reducing the heat to a definite degree, which is impossible with either coal, gas or steam.

(3) Reduced labor costs—a turn of a switch is all that is required—as compared with coal or steam; the two latter entail increased cost for cartage of coal and the removal of ashes, also continual attention to firing, and the cost of cleaning up when either coal has been delivered or ashes removed.

(4) Less floor space required, owing to the fact that electrical apparatus can be installed in almost any position and in some cases mounted on tables or one above the other. The amount of floor space taken up with coal or steam plants is considerable. Gas apparatus is not so bad in this respect, but it can not be so conveniently installed in small places, owing to the risk of fire and need of ventilation. Less floor space also means less rent, which in some cases is an important item.

(5) Economy in food, owing to less shrinkage of meat and less waste of food, mainly with cakes, pastry, and bread, caused by unequal distribution of heat with gas and particularly with coal apparatus.

(6) Saving on the renewal of kitchen utensils. This is a very heavy item when coal is used for boiling, frying, etc.

There are many other incidental advantages, but the above are in themselves sufficient to justify the installation of electrical apparatus.

Fig. 2 shows the layout of a canteen kitchen designed and in course of construction by the author. It will be observed that arrangements have been made to carry out efficiently the preparation of food for cooking by the use of auxiliary plant—meat and vegetable choppers, potato peelers, etc. The kitchen is situated between the dining rooms, the plant being designed to supply the cooked food for 1500 persons at one sitting. Special attention has been given to insure quick service, and the washing-up arrangements are such that plates, etc., are cleaned with a minimum of handling. The total load connected is approximately 350 kilowatts.

The charts reproduced in Fig. 3 show the nature of the loads on the four respective installations, the lower chart being a summation of the other four. These charts of supply should be of special interest to central-station engineers, as they indicate how similar installations will affect the load on their stations and networks. They also form a guide as to what one may expect in the future when the majority of large kitchens are run by electricity: In the author's opinion this is only a question of time. With the advantages of electricity in such applications, and the unity of electrical engineers, there is very little to prevent the desired results from being achieved in the near future.

It is, of course, assumed that the central-station engineer, or the sales engineer, has a thorough knowledge of cooking apparatus and the performance before he starts his campaign; if not, either the services of an expert must be secured, or any attempt to increase the cooking load must be postponed until he has mastered the subject. The best way of buying his experience—and it can only be bought—is to erect a trial installation where he can closely watch its behavior; by so doing he is getting his information first-hand, from which he can lay his plans for future developments. If those engineers who have not yet attempted the large cooking business will look around their districts, they will be surprised to see the enormous amount of revenue that awaits them from large staff-feeding establishments, cafes, restaurants, etc., which will fully justify the first trial installation.

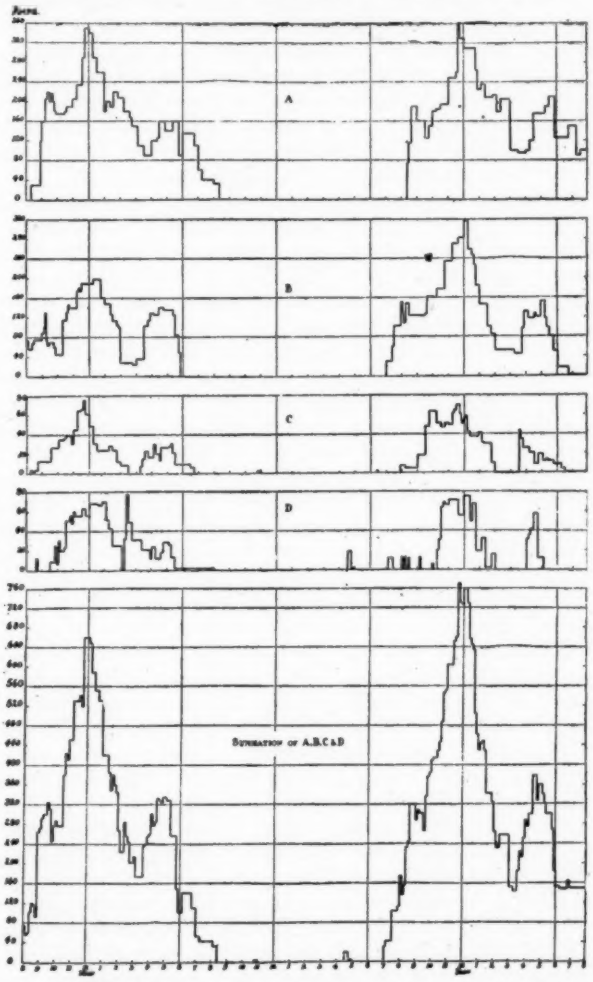


Fig. 3.—Load Curves of Installations A, B, C and D, and of the Four Combined.

[It should be noted that the installations described in Mr. Gillott's paper above have given the excellent results he reports *under war conditions*. Even more favorable results should therefore be expected in normal times.—Editor.]

The Utilization of Pulverized Coal

A Discussion of the Possibities of More Efficiently Utilizing Our Fuel Resources by Use of Pulverized Coal and Methods of Preparation and Handling

THE availability of a fuel which is of such a nature that it can be applied to a large number of different conditions is of vast importance to those interested in any development which tends toward economy and reduction of fuel requirements.

In a paper presented recently before the Cleveland (Ohio) Engineering Society, the question of the use of pulverized coal was discussed by H. G. Barnhurst, chief engineer of the Fuller Engineering Company, some very interesting points being brought out.

Practically any coal can be burned in pulverized form with a proper furnace and burning equipment. Each application, however, must necessarily be governed by the quality of the fuel available in the district in which it is made. Generally speaking, however, the coals which would give the most satisfactory results would be those in which the ash content would be less than 10 per cent, the volatile averaging between 30 per cent and 40 per cent and the fixed carbon between 40 per cent and 50 per cent. The sulphur content should be low, although coal with a sulphur content running as high as 5 per cent is being burned in pulverized form under boilers without any detrimental results. The ash should have a high melting point. These statements, however, are tentative, as most excellent results have been obtained from all sorts of coals, differing widely from the ideal analysis stated.

It is very apparent that the development in this method of burning coal has brought coals from which heretofore very inefficient results have been obtained within reach of a great many consumers. For instance, from Texas to Edmonton, Alberta, the country is underlaid with various grades of lignites, low-grade mineral coals with high moisture content and of such a nature that the ash would melt or flow down on the grates, thereby preventing the highest efficiency from being obtained. They are of such a nature that their use in gas producers is not very satisfactory, so that until the development and burning of these coals in pulverized form was an assured success they were not used in as large quantities as is now possible.

The largest deposits of lignites and mineral coals appear to be in the Northwest awaiting future development when proper means are at hand for obtaining the highest possible economy from their combustion, and the location of these large deposits will now be of great value to the districts in which they are located.

Around steel plants there are large quantities of waste fuel such as coke breeze. This fuel is being used to a certain extent on some form of grates, with forced draft, but it can be burned in pulverized form under boilers for generating power and possibly in open-hearth furnaces for making steel.

In the anthracite field there are large quantities of coal daily pumped back into the mines, which coal is a result of the washing and crushing operation to bring the coal to commercial sizes. This silt, or washery waste coal, carries as high a heat value normally as the coals which have been operated upon. The president of one of the large coal companies in the East said that in the neighborhood of eight or ten million tons of this silt annually was pumped back into the mines to fill up old workings.

A number of the coal companies are now carefully investigating the application of anthracite, or low volatile coals, with a view to using this waste coal in pulverized form to obtain power, thereby releasing for the market the coals of higher grade which they are firing at the present time.

Pulverized anthracite is now being burned in one or two installations, and Mr. Barnhurst has burned pulverized anthracite in a special form of furnace.

Preparing and Handling Pulverized Coal.

The coal, as received, is either in the form of slack, lump, or run of mine, and as it comes to the pulverizing plant it should be crushed so that it will go through approximately a 1-inch ring. A single-roll coal crusher of approved make is usually the equipment employed. The coal should then be dried at low temperature to eliminate the moisture. Ordinarily it should be dried so it will not contain more than 1 per cent moisture. A low moisture content in the pulverized coal as fired in metallurgical or other furnaces leads to uniform temperature conditions which are highly desirable. This condition is also necessary in order to obtain a product of the highest quality. The highest efficiency is also obtained with *dry* coal.

The drier is of the rotary type; that is, the coal is fed into an inclined shell mounted on rollers and is gradually passed through the drier by gravity. The firing chamber is usually located under the shell, or so arranged that the products of combustion from the drier can be used not only to heat the shell of the drier but also to pass through it in order to obtain the greatest economy from the fuel burned for drying the coal.

The drier should be so arranged that the gases of combustion coming from the furnace do not come in contact with the coal being dried until they are reduced in temperature so they will not ignite the coal. The temperature of the coal being dried should only be sufficient to drive off the moisture; if the coal is allowed to become too hot, the volatile content may be reduced, thereby sacrificing some of the heat value of the coal. This condition is very readily obtainable, as practice has shown. A pyrometer should be installed to indicate to the operator the temperature to which the coal being dried is exposed. An evaporation of from 5 to 7 pounds of moisture from the coal being dried can be readily obtained per pound of coal burned on the grates in the drier. The amount of evaporation however naturally depends upon the quality of the coal being handled in the driers. The driers can also be fired with pulverized coal if desired.

A magnetic separator of some standard make is installed, either before the crusher or after the drier, so as to remove what may be called tramp iron which consists of pick points, railroad spikes, coupling pins, links, hammer heads, sledges, tobacco cans, nails, etc., all of which have been accumulated in the mines and in the crushing operation at the mines. The amount of iron per ton will vary in certain districts but it is an item of such importance that magnetic separators

are being installed in every first-class pulverized coal plant which is now being erected. The elimination of this iron naturally improves the pulverizing and conveying operation, and prevents breaks and losses due to intermittent operation, and lessens the wear and tear on the machinery.

Coal as it is passed through a modern pulverizing plant should be elevated and conveyed in dust-tight equipment. After crushing, the coal should be elevated to bins above the driers. These bins should be of ample capacity and arranged with variable-speed feeding mechanism so that the driers at all times will have uniform feed. This is very important in order that the moisture content be reduced uniformly and thereby allow close furnace regulation where the fuel is burned. Leaving the drier the coal is elevated and discharged into storage bins above the pulverizers. These storage bins should be of such capacity that the pulverizing machinery will at all times receive ample feed to prevent them from running empty. All storage bins should be of dust-tight construction, and equipped with deep hopper bottoms so that the coal is constantly in motion while being drawn off. It is in coal lying dormant or stationary that spontaneous combustion or smoldering action is generated, particularly so where coals are under pressure.

Danger of Spontaneous Combustion no Greater Than With Other Forms of Coal.

The danger of spontaneous combustion of pulverized coal has been greatly exaggerated. It has been considered that the matter of pulverization increases this danger, but it is a matter of fact that practically nothing more than the usual ordinary precautions taken with all fuels are necessary to guard against it. The mere factor of pulverization is not of any unusual importance as is readily shown in the commercial production of lamp black, which is handled very much like pulverized coal, without dangerous results. This lamp black is probably 30 to 50 times finer than the average size particles found in commercial pulverized coal.

In the lamp-black industry, by the way, it has been found that only partially filling the barrels when shipping gave much better results than when packing the material to the top.

Spontaneous combustion results simply from the absorption of oxygen. If this absorption becomes too rapid, heat will be generated and incandescent combustion will result. The presence of pyrites tends to oxidation to a rapid extent in any fuel, with the probable disengagement of light carburetted hydrogen, and spontaneous combustion results. In the case of lamp black, this condition of course is removed as the lamp black contains practically no sulphur. Certainly not in the form of pyrites.

Pulverizing.

Pulverizers of ample capacity to take care of the fuel requirements should be of such a nature that their cost of operation, attendance, power, and repairs are at a minimum. A first-class pulverizer should be one which can operate if necessary over a period of from one to three months continuously without shutting down even for oiling. The pulverizers should also be of a type that normally delivers a product containing the highest percentage of impalpable powder. Coal should be pulverized so that ordinarily 95 per cent will pass a 100-mesh sieve. The machinery in the pulverized-coal plant, where possible, should be driven by electric motors. The drives should be standardized and the motors interchangeable. Back-geared motors are successfully used in a great many installations, and the pulverizers can be driven either by motors with belt drives or gear drives with a flexible coupling between motor and pulverizer.

Dust collectors are sometimes installed in connection with driers. This dust is formed by the action of the coal passing through the drier, as the coal falls down a certain amount is ground to dust and this dust, being in suspension, is carried along by the air currents through the drier; the dust collector will recover it. Dust collector should also be arranged in connection with the pulverizers.

Cost of Preparation.

The adoption of pulverized coal for any particular operation naturally depends on the cost of preparation or handling, which is a charge in addition to the fuel itself. However, in a great many cases the original cost of the fuel is less than that where lump coal is used. The power required in a first-class pulverized-coal plant, per net ton of coal handled, is in the neighborhood of 17 horsepower-hours per ton produced. Since the efficiency of the motors will average about 89 per cent, the corresponding power consumption will be 14.3 kilowatt-hours. This includes the power for crushing, drying, elevating, conveying, and delivering the pulverized coal to the conveyors leading to the point of use. The repairs vary slightly with the quality of the coal, but generally speaking the repair costs for the pulverizing plant should be somewhere between 5 and 7 cents per net ton of coal handled.

The drier fuel is practically a constant, as the amount required per ton of coal dried, with a given moisture content and with standard driers, will not vary very much.

In the Lehigh Valley district, where the coals carry from 5 to 10 per cent moisture as received, 25 to 35 pounds of coal are required to be burned on the grates per ton of coal dried. The cost of this coal is naturally based on the cost of the coal as received. The great variable in the cost of preparing pulverized coal is then reduced to the labor item. The labor varies inversely with the quantity of coal handled and the time or continuity of operation in the pulverizing plant. In other words, the question of labor cost is one directly affected by the equipment installed. One man can handle quite a number of machines, so that in making up an estimate on the probable cost of pulverizing coal, careful consideration should be given to these statements.

Generally speaking, coal in fairly large quantities, from 50 to 100 tons and upwards per day, can be pulverized and delivered to the furnaces at a cost from 20 to 50 cents per ton, depending upon the quantity handled. Nothing has been said, however, as to interest and depreciation, taxes, overhead, and other burdens entering into the ultimate cost of preparation, as these are items which have to be considered in each specific case. For instance, the cost of a pulverizing plant, if it is to be operated 10 or 12 hours per day, would be considerably greater than an installation to turn out the same production in 24 hours. The cost of preparation will vary also with the investment, for a given production, done in one shift, will naturally be accomplished at less cost than if it required two or three shifts.

To make a positive statement as to the cost of any given sized pulverized-coal plant today is rather difficult, in that the conditions governing every installation vary. Generally speaking, however, an ideal plant with a daily capacity of 100 tons of pulverized coal

will cost today, with the present prevailing high prices, in the neighborhood of from $300 to $400 per ton of capacity. The cost of a plant for 250 tons daily capacity of pulverized coal will be from $250 to $300 per ton. These are just general statements to give some idea as to the cost of pulverized coal plants. Information on this subject can be readily obtained from those familiar with the matter.

To the cost of the pulverizing plant there must naturally be added the cost of the conveying system to the furnaces, also the storage bins, burners, etc., as well as the air supply.

When making comparisons between different methods for burning coal, in order to be fair and just, the cost of each equipment should be considered from the time the coal is received on the track until it is delivered into the furnace. The storage of the raw coal is a condition always necessary; the conveying and handling of this coal from storage to the plant is also a necessity. The handling of any coal at furnaces, particularly with boilers, requires the installation of bins and spouts. These items are the same whether stokers or pulverized coal is used for firing. The cost of preparing pulverized coal, as stated above, would sometimes lead one to believe that the cost is excessive and that it is a cost due entirely to the pulverizing of the coal; but the cost of preparation, as just outlined, includes items which are common to any system of mechanical firing.

For instance, the distribution of coal in certain plants requires hand labor, so in each case a careful study should be made of the conditions governing the installation, the cost of the present operation, and the cost of the pulverized-coal installation, and its cost of operation, before arriving at a decision as to the advantage of one system over another.

There are too many pulverized-coal plants in existence today to allow a careful engineer to be misinformed as to the ultimate cost of the preparation. The cost sheets of plants using pulverized coal for years are readily obtainable.

Conveying Systems.

The subject of pulverized-coal handling from the pulverizers to the point of use is also important. The application of any particular method depends upon the distance to which coal must be transported as well as the quantity to be handled per hour. The general practice in plants where pulverized coal has been used for a number of years, and in plants where the capacity would be from about 50 tons per day upward, is the use of screw conveyors for conveying the coal. These screw or spiral conveyors are mounted in dust-tight troughs. The gudgeon forming the connection between the different sections of the conveyor runs in chilled bearings and when properly installed its upkeep is very low. They do not require much attention, and the bearings last for years, the coal itself acting as a sort of lubricant. Coal after being pulverized only weighs from 32 to 38 pounds per cubic foot and is permeated with air and flows along the conveyors like a fluid. The power consumption for distribution with this system is the lowest of any, and when properly installed this system is dustless.

There are other means of conveying pulverized coal, such as carrying the coal is suspension. More power, however, is required for furnishing air to carry the coal in suspension, and at such a velocity as to prevent its building up in the blast pipes, than is used where screw convevors are installed. The necessity of closing up every leak, and the possibility of moisture affecting accumulations in the transmission lines, make a system of this kind usually expensive to operate.

Another method now being developed is the conveying of pulverized coal through pipes by means of compressed air. With this system the coal enters the pipes in charges, compressed air being used as a means of propulsion. Relief valves and cyclone* collectors, naturally, must be installed to relieve the pressure after the charge has been delivered at the receiving point. This system is installed in three or four plants. It should be considered where coal is to be transported a long distance, but it is not applicable to short-distance transport.

Conclusion.

The pulverizing action increases the superficial area of the coal, thereby rendering its combustion far easier of accomplishment and more complete, since each minute particle will be surrounded by sufficient air to insure its combustion. It is evident, also, that the more finely divided the coal is the more readily it can be satisfactorily burned, and under proper conditions *is absolutely smokeless.*

Summing up the whole subject, it may be seen that the use of pulverized coal has no insuperable difficulties to overcome, but merely those which have always hampered the introduction of new methods. Pulverized coal is here to stay, for it is very closely allied to the conservation of our natural resources.

St. Louis Jovian League Holds Christmas Feature Meeting.—The St. Louis Jovian League held a very interesting meeting at the American Annex Hotel, Tuesday, December 18, in which lady relatives and friends of the members participated. As it was the last meeting of the year, it was designated "A Christmas Feature Meeting." G. Platt Knox, assistant superintendent of public schools, was the speaker of the occasion and delivered a splendid lecture, illustrated with slide pictures entitled, "Jerusalem to Bethlehem." The meeting was under the auspices of the Allis-Chalmers Manufacturing Company, and was presided over by C. L. Orth, district manager of the company, assisted by Herman Spoehrer, treasurer of the Union Electric Light & Power Company. In the absence of President Matthews, Frederic A. Kehl, former president of the league, presided.

Chicago Jobber Gives Insurance Policies as Christmas Gifts.—The Monarch Electric & Wire Company, prominent electrical jobber of Chicago, Ill., has presented each of its employees with a paid-up life-insurance policy as a Christmas gift. Every employee from the office boy to the president is involved and the policy remains in effect as long as connection with the company is maintained. The policy is with the Equitable Life Assurance Society and is a special type of group contract which covers every employee regardless of age or physical condition. Such a gift is therefore particularly welcome to those who would not be eligible to insurance if applied for individually. An interesting coincidence in regard to this particular transaction is that the contract with the Monarch company was written by Charles A. Howe, district manager at South Bend, Ind., for the Equitable, who for many years was in the electrical business as Chicago manager for the Holophane Company.

*"Cyclone" is used to designate the systems for carrying pulverized coal in suspension.

Editorial Comment

Interpreting the "Lightless" Nights Order

SOME confusion has arisen in many cities of the country as to the full meaning and interpretation of the United States Fuel Administrator's order of December 14 decreeing that Sunday and Thursday nights are to be in a large measure "lightless" nights. Most of the confusion was due to delays in sending out official copies of the order which in many places were not received until several days after the order was supposed to go into effect. Those interested were therefore compelled to get their early information from more or less inaccurate or incomplete newspaper accounts. The order, moreover, reads as if it were merely an amendment of the original one of November 9, which restricted certain outdoor display lighting, thus apparently extending the restriction on Sunday and Thursday nights. On careful comparison of the two orders, however, the amendment is found to be a substantially complete cancellation of the earlier order.

On account of the misunderstanding, many central-station companies at first advised their customers to the effect that the newer order meant further curtailment of lighting on the two nights each week, whereas the earlier restriction has now been rescinded and replaced by the so-called "lightless" nights. Such confusion, on top of the other unfortunate effects of the order already pointed out in our issue of last week, is to be deplored. It could easily have been avoided by sending copies of the order to all interested well in advance of the date the new regulations were to go into effect, together with such explanatory matter as would evidently be needed to clear up the involved language of portions of the order. There are well established channels in the electrical industry for giving out such information accurately and quite promptly so that dependence on garbled newspaper reports would not be necessary.

The new order specifically exempts lights in such number and size as are necessary to meet the requirements of public safety, the decision on what lights are necessary for this purpose being left to the state fuel administrators. It is becoming evident that quite varied opinions are being held on this very point. As already pointed out last week, comparatively few streets in American cities have sufficient lighting from the safety standpoint, this opinion being held by police and traffic authorities, automobilists and other drivers, as well as by pedestrians and citizens in general. It is well known that insufficient and improper lighting encourages crime and increases accidents. Let us hope, therefore, that the safety requirements will be liberally interpreted. This should apply not only as to street lighting but also as to lighting the entrances and exits of hotels, theaters and other buildings in which there are many persons; meager lighting may mean disaster in case of fire or panic, and even in normal times may promote the activities of pickpockets. The common custom of letting one or two lamps burn all night in stores for the ready detection of burglars or other prowlers should be maintained.

It is to be hoped that the Government's taking over of the railroads will relieve the coal-traffic congestion on these lines, and that the proposed taking over of the coal mines, if carried out, will effectively solve our national coal problems, so that light—the emblem of enlightenment—may be permitted to promote safety to a liberal degree.

Co-operative Electric Cooking Boosting

IN the past high energy rates, the conservatism of the housewife and the high initial cost of electric ranges have been considered the chief barriers that stood in the way of the wide application of electric cooking and heating. Today electric cooking rates are found quite widely; while the conservatism of the housewife is fast disappearing as experience with electricity in other applications proves its worth. The cost of electric heating and cooking equipment is possibly waiting the coming of greater demand, in keeping with the laws of supply and demand, although prices are steadily decreasing with the increasing inauguration of the cooking rate. However, the initial cost of cooking ranges is still such that some central station companies courting the cooking and heating load are absorbing a portion of the initial cost of the range and its installation, feeling that in this way such a load is encouraged, and loads are obtained that might otherwise be unprocurable.

In following this practice of overcoming the initial cost of electric cooking and heating equipment some companies have "adopted" one make of range, which they recommend and install partly at their own expense. This is equitable where any range possesses radical advantages over other makes of ranges. But the choice and preference has not been made upon a basis of merit, but instead seems to be that a company having used one make of range has adhered to it, perhaps because doing so simplifies matters such as service connections, space requirements, bookkeeping and spare parts.

But this is not the complaint. The complaint is that while adopting one make of electrical range and absorbing a percentage of its initial cost these same companies refuse to absorb the initial cost of other

makes of ranges. Thus a prospective user of electric cookers who prefers to choose his own range for commercial, sentimental or other reasons, finds himself under the disadvantage of having to carry the entire initial cost whilst his neighbor purchasing the range handled by the utility receives the benefit of lower cost, or accept the range used by the utility. And so also the manufacturers of electric ranges other than those handled by the local utility find themselves discriminated against and their ability for doing business greatly handicapped. This state of affairs has not risen intentionally, but it is none the less effective in retarding the adoption of electric cooking loads. The much-talked-of unification of effort and co-operation does not exist but instead there is unfair competition and restraint of trade.

Absence of a centralized plan of campaign in the field for the healthy development of the electric cooker and cooking and heating load, for which the appliance manufacturers and the utilities are in spirit co-operating together loyally, will not prevent electric cooking and heating from eventually coming into its own. But it will delay the day, and work an unfair hardship upon many who are helping and would hasten even more the day of electric cooking. For the sake of all concerned, the public, the utilities and the electric range manufacturers there must be equitable co-operation and concerted action if the electric heating and cooking load is to receive the impetus its value as a conserver of fuel and food and as a load builder deserve. We must work together for the common good. There is room for all and in helping all we help ourselves. Without co-operation and the co-ordination of interests the coming of universal electric cooking must remain a dream afar instead of one in the making.

Harnessing Water Power

THE passing year has emphasized the fact that coal is the alpha and omega of industrial and commercial supremacy and national existence. The last few months have brought home to us with unaccustomed and unpleasant abruptness and painful force the knowledge that while our very existence depends upon coal, and ample coal, our coal supply depends in turn upon the ability of the railroads to haul it and the willingness of the miners to mine it.

The fuel fiasco, or rather dilemma, since it is as yet by no means passed, has once more caused the question of utilizing our water powers to emerge from its troubled slumbers. Water cannot take the place of coal for about one thousand purposes, not including heat. But it can replace coal as a form of energy in many instances, and eventually must do so where economically feasible. To talk now of conservation of labor, of time, of materials, of fuel in fact, of everything save water power—the white diamond as contrasted with coal, the black diamond—is to make a mockery of conservation and a plaything of national necessity. Realizing the situation, though many have foreseen it long ago and attempted and implored that action be taken to prevent it, attention is once again directed with special emphasis as in many occasions in the past toward the conservation of coal by the utilization of water upon a serious scale, and simultaneously therewith do so much toward relieving a failing railway system.

The development of water powers for the use of man, and without in any way detracting from the quality of the water and only using its stored energy has in the past with few exceptions depended almost entirely upon private initiative, enterprise and capital for development. But private capital can not develop water powers held in uselessness by a government that will neither specify what it wants done or what it will do, nor that will listen to pleadings for their use. Private capital asks only for a stable working policy that offers at least some guarantee of permanence, instead of none at all or one that changes from day to day and year to year, one empty of results and undependable.

During the passing year the famous Niagara River station of the Buffalo General Electric Company has come into the being almost under the shadow of the Falls. Today it stands a magnificent monument of private enterprise and a symbol of governmental inactivity. This station, probably the last word in the way of efficient steam production upon a vast scale, was carefully and deliberately planned, executed in masterly fashion and with wonderful skill with set purpose in mind—efficiency. Not far away torrents of water pour to waste, a glaring example of colossal extravagance. The one is a magnificent example of private accomplishment and set purpose; the other a flaring example of incompetence and vague inaction. The steam plant that is now competing with Niagara is as much a credit to private enterprise as it is a discredit to a government blind to the country's needs and the spirit of conservation that through indecision and hesitancy and inaction and lack of policy has placed the country in a false position.

The passing year has taught us many things—things we might have learned at less expense had we had the vision that comes of willingness to learn, had we been less self-satisfied. Foolish, fussing, self-centered congressmen, earnest but small with the smallness of their ilk, are wasting time and allowing water power to go to waste that could serve the nation in this its time of need. The present policy, or rather lack of policy, is inimical to the spirit of conservation. It is anathema to national well-being. The time has come when the intrinsic and economic value of coal, when the condition of our railroads demand that water-power development be taken up and settled upon a sound and possible basis, that will enable them to be used and not wasted. The interests of the nation demand that water powers be developed and that forthwith the Government formulate a dependable working policy. And, moreover, the country expects that this policy will be evolved and prosecuted with the same aggressiveness that the war is being prosecuted.

Week's Events

Coal Situation at Cleveland and in Kentucky—Indiana's Standards for Electric Utilities—Equipment in Paper Mill—Electrical Christmas a Success—Doherty Plant Extensions—Index Ready

COAL SHORTAGE AFFECTS CLEVELAND COMPANY.

Power to Factories Curtailed so That Railway and Residence Business Would Not Suffer.

The coal shortage which reached an acute stage in Cleveland, Ohio, on December 15, made it necessary for the Cleveland Electric Illuminating Company to discontinue service to about 100 of its largest power customers.

Inasmuch as the company furnishes most of the power used by the Cleveland Railway Company, and for street lighting it was either a matter of stopping street-car traffic and allowing the city to remain unlighted, or of curtailing industrial power.

The second alternative was taken, notwithstanding the fact that many of the industrial concerns affected are turning out rush orders of war materials.

Domestic current, furnishing light for 100,000 homes of Cleveland, will not be cut off, it was stated.

Officials of the company declared that if action to save fuel had not been taken the entire supply probably would have been exhausted by Monday morning, December 17, in which event street cars would have to stop and the city would have no electric power save the comparatively small amount furnished by the municipal plant and the Cleveland Railway Company.

The company requires fifty cars of coal a day to operate. Most of its supply comes from mines the entire output of which it has contracted for. The cold weather has so paralyzed railway traffic that it has been impossible to move coal to the plants in sufficient quantities to maintain a normal supply.

NEW STANDARDS FOR ELECTRIC UTILITIES.

Uniform Rules Being Considered by Indiana Public Service Commission.

The Public Service Commission of Indiana has before it for adoption a new set of standards for electric utilities within the state of Indiana. The new standards are declared to be of such excellent construction that engineers in several parts of the country already have approved them.

The standards were worked out after many conferences held by Harry O. Garman, chief engineer of the Commission, following authorization by the Commission of such uniform standards for electric utilities.

The standards have to do with records and reports, meters, meter-testing equipment and facilities, meter accuracy, information for consumers, adjustment of bills for meter error, incandescent lighting, deposit by customers, operation and maintenance, standard frequency, standard voltage and permissible voltage variation, voltage surveys and records, interruption of service, station instruments, station records, accidents, grounding of low-potential circuits, extension of lines, pole identification and many other topics.

Conferences were held with J. Franklin Meyer, associate physicist of the United States Bureau of Standards, and frequent reference was made to similar sets of standards and similar work of such commissions as those in New York, New Jersey, Illinois, Wisconsin, California and Kansas, before the engineering staff of the Indiana Commission was ready to submit the proposed standards to the managers of private and municipal utilities in Indiana for suggestions from them.

ENGINEERING STUDENTS SHOULD NOT BE SUBJECT TO DRAFT.

Resolution of Engineering Council Urges Encouragement of Graduation by Students Because of Nation's Need.

A meeting of the Engineering Council was held on December 6 in the new board room of the American Society of Civil Engineers, Engineering Societies Building, New York.

A committee which has for sometime been searching for a suitable man to act as a permanent secretary for the Engineering Council for United Engineering Society and for Engineering Foundation having concluded their labors, unanimously recommended Alfred D. Flinn. The resignation of Calvert Townley, who has held office since the organization of the Engineering Council, was accepted with expressions of appreciation for services rendered, and Mr. Flinn was elected to the vacancy, his term of office to begin January 1, 1918.

Council adopted a report of its committee on rules providing a method for electing to its membership additional engineering and technical societies. The rules now adopted go to the governing bodies of the four founder societies for consideration.

The matter of the administration of the National Selective Draft Law with respect to students in engineering schools having been recommended to the consideration of the Engineering Council, the following resolution was adopted and was thereupon telegraphed to the Honorable Newton D. Baker, Secretary of War, and General Enoch F. Crowder, Provost Marshal, viz.:

"Resolved, The Engineering Council, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, recognizing the serious responsibility of the engineer for the successful prosecution of the war, in the many branches of the National service where highly trained engineers are required,

urges the importance, as a war measure, of maintaining unimpaired the engineering strength of the Nation, for the successful prosecution of military operations, and for the support of sustaining industries.

"Since schools of engineering are the principal sources from which trained engineers may be drawn, the Engineering Council urges that in the administration of the selective draft the Government should maintain these schools in full operation, and should take such steps as will enable qualified engineering students to continue their studies to graduation, if possible, and, in any event, until necessity demands their call for active service.

"This recommendation is made for the sole purpose of insuring the continuous supply of trained engineers for the future service of the Nation."

ELECTRICAL EQUIPMENT OF A PAPER MILL.

Interesting Motor Applications and Plant Arrangement of Kalamazoo Factory.

The electrical equipment being installed in the new factory of the Kalamazoo Vegetable Parchment Company, Kalamazoo, Mich., is of interest, as showing what the requirements are for a modern plant in which waxed and parchmentized papers are produced at the capacity of 50 tons per day. The concern mentioned has been engaged many years in that line of manufacture. Its business outgrew its old plant, and its expansion is represented, in part, by groups of new buildings covering about 10 acres of land. In this article attention will be confined chiefly to the steam-electric features and the equipment necessary in providing motor drive for numerous machines.

The company has installed facilities for producing all the electric power it will require. To accomplish this a steam plant of five Wickes vertical water-tube boilers, each of 300 horsepower, 200 pounds pressure, 125 pounds superheat, have been put in position. These boilers are equipped with Murphy stokers and Green fuel economizers. The coal is fed from overhead coal bunkers, supplied from outside storage by a locomotive crane. Draft for the boilers is furnished by a concrete stack, 7 feet diameter and 280 feet high, built by the Weber Chimney Company. The main steam line connects with a General Electric steam turbine, bleeder-type, direct-connected to a 1250-kilowatt, alternating-current, 3-phase, 60-cycle generator, for operation at a speed of 3600 revolutions per minute and a pressure of 440 volts. The exhaust steam passes to a Reese roto-turbo jet condenser, manufactured by the Manistee Iron Works.

The switchboard consists of a General Electric black slate, 9-panel installation, with Tirrill regulators, instantaneous reading meters, and having remote-control switches in the basement. There are two 60-ampere light transformers, and each of the six factory departments is equipped with a distributing panel for motor control, and there are 15 light distributing panels advantageously situated to serve the works. These panels were furnished by the Mutual Electric Machine Company, Detroit. The electric power requirement will amount to 930,000 kilowatt-hours per month and this will be dispensed through 31 alternating-current motors, representing 2340 horsepower. The largest power concentration is in six 150-horsepower motors; four of these will operate Jordan pulp machines with which they are direct-connected by coupplings fastened by interlocking devices; the other two 150-horsepower motors are direct-connected by flexible couplings to water pumps, the couplings being fastened by laminations of spring steel. A series of washers are likewise motor driven, one 100-horsepower motor operating two machines. Heaters, rotary cookers, stock pumps and five elevators comprise some of the other motor-driven equipment. All motors are of General Electric manufacture.

The idea of installing a large steam plant was not wholly with the object of generating electric energy for motor drive, but was also to supply the large volume of exhaust steam for heating and drying, and it is figured that this requirement will amount to nearly 9,000,000 pounds per month.

A contract for the wiring and conduit installations and panel and motor installations was carried through by Dewey Hinckley of Kalamazoo. Under this contract, he furnished the wires, conduits and panels and supervised all installation work, except that of the turbogenerator, which came in under General Electric supervision. Mr. Dewey's contract amounted to about $15,000.

Another use for steam power at the plant is for driving three Ingersoll-Rand air compressors, each of 800 cubic feet capacity, the compressed air being used in pumping 7,000,000 gallons of water per day from 12 wells, that volume being required for factory uses. These wells have an average depth of 200 feet, and are a distance of 1000 to 1500 feet from the plant. The water is forced through pipes to a central receiving tank, from which it flows by gravity to the factory. The actual distribution of water in the plant and the handling of semi-liquid material will be by means of electrically operated pumps.

The new plant, which is to be ready for operation by February 1, is costing about $1,000,000. It secures wood pulp from pulp mills in the North and West, and uses sulphide material and other substances for paper and parchment treatment.

AMERICA'S ELECTRICAL CHRISTMAS A SUCCESS.

Society for Electrical Development Reports Unexpected Demands for Literature and Sales Helps.

Widespread reports indicate the success of the nation-wide "America's Electrical Christmas" campaign, conducted under the general direction of the Society for Electrical Development.

Unprecedented sales activity in all parts of the country, particularly by contractor-dealers has resulted in a truly electrical Christmas.

All of the advertising and sales effort were built around the practicability of electrical appliances. The Christmas shopper this year looked for useful presents and the advertising by electrical interests directed attention to the electric shop.

This year, more than ever before, men in the industry took their own advice and gave electrical presents.

The headquarters of the Society in New York were overwhelmed with demands for Christmas display and newspaper helps. By Saturday, December 8, almost all matter had been shipped by the special shipping force that had been engaged for the occasion.

The campaign was not intended to be as spectacular as the big electrical weeks of previous years, but the Society had not anticipated so big a rush for sales helps, which in some respects rivalled the 1916 campaign.

An interesting point this year was the demand for envelope stuffers, poster stamps, and the smaller material instead of so much of window lithographs and the larger displays. The feature helps for this year such as poster stamps, 150 Christmas Gift Suggestions, sets of price cards, folders, wreaths, went early in the big rush and the supply was exhausted even after reorders.

It was necessary to reduce many orders for direct-by-mail material as there was not time in which to order reprints and then make timely delivery.

Some of the material supplied embraced 13,000 campaign announcements, 13,000 copies of the attractive November Sales Service containing the holiday sales suggestions, 5332 window posters, 5077 window cards, 2500 sets of price cards, 16 to a set or a total of 40,000 cards, 2082 door wreaths, 228,000 poster stamps, 200,000 suggestions folders, 36,000 circular letters.

The campaign also resulted in the Society obtaining many new members. Over 30 have joined within the past five weeks.

Following "America's Electrical Christmas" the Society is continuing with its regular activities, modified or increased as the war demands change conditions. It is preparing certain new "How to" booklets for use of member's salesmen and new employees, the subjects generally relating to facilitating the sale of practical electrical appliances and factory equipment.

Considerable time is now being given to propaganda work for electrical equipment in freight terminals. Electric furnaces are receiving the attention of part of its engineering staff.

Special effort is directed to helping the contractor-dealers care for the merchandising activities which some of the central stations have necessarily been forced to discontinue. Much of the Society's work is for the retailers of electrical appliances.

INCREASED DEMAND MAKES EXTENSIONS NECESSARY IN DOHERTY PLANTS.

Four New Turbines Installed in Western District and Other Additions Made During Year.

The electric output of the plants in the Western district of the Doherty Organization has increased from about 12,000,000 kilowatt-hours per month last year, to 15,000,000 kilowatt-hours this year. This large increase necessitated greater generation capacity, and the following installations have been made to meet the increased demands:

The plant of the Empire District Electric Company at Joplin, Mo., recently put into operation its new 12,500-kilowatt General Electric, 6600-volt, 25-cycle, turbogenerator, equipped with a Westinghouse Le-Blanc jet condenser. The turbine is designed to operate on 200 pounds steam pressure and 100 degrees Fahrenheit superheat, and with a 28-inch vacuum, the water rate will be about 13 pounds per kilowatt-hour.

At St. Joseph, Mo., the plant of the St. Joseph Railway, Light, Heat & Power Company has recently put in operation a new 5000-kilowatt bleeder type General Electric turbine. This type of turbine permits a maximum steam extracation of 40,000 pounds of steam an hour at 5-pound pressure for steam heating purposes. A 7000-square-foot Alberger surface condenser is used to maintain the vacuum. The turbine is designed to operate on 150-pound pressure, using dry saturated steam, and will have a water rate of about 16 pounds per kilowatt-hour when the vacuum is 28 inches.

The Fremont (Neb.) Gas, Electric Light & Power Company has just completed installing, and will put into service within a few days, the 500-kilowatt Westinghouse turbine and condenser which was formerly used at the old plant of the Mansfield (O.) Electric Light & Power Company. This unit will cause the Buckeyemobile, which has been a notable feature of the Fremont plant, to rank second in importance as a generating unit. The latter will be run only on nights and during periods of light loads.

Hutchinson has a new 4000-kilowatt turbine. A 550-square-foot Westinghouse surface condenser is used to obtain the vacuum. The turbine is designed to operate on 200 pounds pressure and it will have a water rate of about 14 pounds per kilowatt-hour when the vacuum is 28 inches.

COAL SITUATION ACUTE IN KENTUCKY.

Relief Promised by State Fuel Administrator Who Seized Shipments for Local Use.

Relief for the numerous Kentucky electric lighting utilities which were reduced to threatened suspension by failure of their coal supplies has been provided by the state Fuel Administrator, who acted in the interest of all consumers. With the approval of the National Fuel Administrator, he has seized some 150,000 to 200,000 tons of coal on railroad cars billed to points north of the Ohio River. Much of this coal has stood on the tracks for over a week, railroads north of the river being unable to receive it from the Louisville & Nashville, which road is co-operating with the Fuel Administration in distributing this same coal to Kentucky points which required it. Some of the smaller plants of the state were required to suspend but none of the larger ones for this reason. At Owensboro, Ky., it was necessary to suspend service to all but the business section of the city on account of the fact that the reserve supply of water in the city reservoirs failed. This is explained by the fact that, to prevent freezing of their pipes, it is the practice of many water subscribers to let the water run in zero weather. This exhausted the reserve and threatened the water supply of the lighting plant, which also furnishes the power to the water department's pumps. Water users were instructed to close all taps or be sure that they would have neither water nor light and power until the weather moderated.

The Semi-Annual Index

The index for Volume 71, comprising the issues of July 7, 1917, to December 29, 1917, inclusive, is now ready for distribution and will be sent without cost to any subscriber requesting a copy. It has been the custom in the past to send the index as a supplement to the last issue of the volume, but in view of existing conditions the new arrangement is considered preferable.

Commercial

Minneapolis Company Opens New Office—Methods for Winning the Public —Miscellaneous Commercial Activities

MINNEAPOLIS COMPANY OPENS CUSTOMERS' LOBBY OF NEW BUILDING.

Information Desk Well Patronized and Affords Opportunity to Meet Customers.

Remodeling of the Minneapolis General Electric Company's office building is nearing completion. The new customers' lobby on the first floor was opened December 3, and has made a very favorable impression upon every one. An information desk which has been opened is proving very valuable to the company. In a letter, Sales Manager H. E. Young says:

"The information desk which we have established is proving a source of much valuable information to the company as well as to our patrons. We have had several hundred inquiries every day at this desk and in many instances the information which we receive from customers with respect to their opinions and feelings toward our company is quite as valuable as any information which we are able to give the customer, and it is quite evident that in having the opportunity to talk with several hundred people every day at this information desk, we will add to our opportunities to get in touch with the public, which, together with the numerous means already employed by us, will still further strengthen our hold upon the good will of the people."

WINNING THE PUBLIC TO YOUR SIDE.

The Public Must Be Taken Into Confidence if Utilities Are to Develop Under Present Conditions.

In connection with the present fuel shortage, the impossibility of making extensions where needed and the necessity for raising rates, the greatest need of the moment, according to H. W. Alexander, is for the utility companies to take their story directly to the people over the heads of commissions, municipal authorities and legislatures. Speaking before a recent convention of southern central-station representatives Mr. Alexander said that rates may have to be raised because of necessity. The people must pay the bill, and they will want, and are entitled, to know exactly why.

Do you ever look upon this same public as an investor? Do you realize that it is the same man in the street whose money revolves the whole of your machinery—and which goes into the pay envelopes of your workmen? Win this man—win his confidence in your idea—and his willingness to become your partner in exploiting it, and the way is open to successful operation on any scale you choose.

For the public is not alone your customer; but likewise your backer, your workman, your salesman, your lawmaker.

The public must be shown that their interest is best served when capital receives a fair return in good years and in bad, and when their utilities are protected from shortsighted, dishonest and unscrupulous attacks. The co-operation of employes is particularly important.

President Josselyn, of the Portland (Ore.) Railway, Light & Power Company, recently addressed the heads of departments of his company, and in part said:

My theory of publicity in connection with the company is that it rests with every man in its employment to perform a very important function. The acts of each, whether he be a lineman, a meter reader, or connected with the general offices as a clerk, are held by the public to be the acts of the company. I mean that whatever you do or whatever you say, the general run of the people seem to regard it as the official act of the company itself.

General View of Customer's Lobby of New Building of Minneapolis General Electric Company.

Customers' Rest Room in New Building Provided With Telephones and Writing Facilities.

Relations With Contractors.

The central station should meet the contractor more than half way. The work performed by the large contractors brings up the question whether the light and power shall be furnished by the central station or a private plant—the contractor or engineer advises the owners who answer the question—it therefore is necessary to cultivate the friendship of the electrical contractors and engineers, because their recommendations go a long way toward influencing the decision of the owner. Many contractors operate small shops where they display the many electrical devices of all kinds and help to exploit the use of electricity among their customers.

They should work with you in your educational work. Just because they are not as active as you think they should be is no reason for cutting their acquaintance. Some have only graduated from the employee class and they are not up to your level in business. They should be helped not condemned. Remember many of your customers look upon these men as electrical engineers whose word is just as good as, if not better than, yours, in an argument, for the customer feels that the little contractor is for him against you. Cultivate the small contractors, help them make money, and they will help you.

Some Features of Service.

A salesman's work is only half accomplished when he has signed a contract. The other half is to see that the customer is satisfied. It is the salesman's business to know every man doing business or residing within his district and as many of them personally as possible. The solicitor should call frequently to see if the service is satisfactory.

With regard to other relations between company and customer, experience with its "Good Service" department has proved its worth to the Denver Gas & Electric Light Company. Taken on the sharply practical side, each dollar spent in service improvement for the customer has brought a return of $3.00 to the utility. Then there is the larger, broader aspect of satisfying and pleasing the community. Sometime ago the city was divided into seven districts each with its "supervisor" of good service. Each man was given 350 names, it being his duty to spend a three months' period on the names selected. He was to call on each consumer, make a careful examination of the premises and ascertain whether or not the company was giving full, complete and satisfactory service. If, in any way, the service was unsatisfactory, he was to report it to the office and make sure that conditions were immediately remedied. As the "supervisors" employed in this work were excellent salesmen, and came in close contact with the consumer, they were often able to suggest improved service and additional current-consuming devices, which, in many instances, were easily sold, connected up, placed on the lines and became productive of additional revenue for the company.

Newspaper Advertising.

Considering the newspaper side of publicity there is no publicity method so good, none so economical, and none which will produce such quick results and pay such high dividends in actual financial returns as well conceived and well executed advertising which discusses frankly with the people of the country, through the paid columns of newspapers and periodicals, the business problems of common interest. It is the surest and most effective means, not only of reaching the public understanding, but also of inspiring public confidence, which is the basis of all progress in democracy.

An advertisement three columns wide, and half to three-quarters of a column deep, is generally big enough to stand out well on a newspaper page, if not, indeed, to dominate it. It is important that the advertisement be simple and direct and as brief as possible with clarity. Seldom should such an advertisement have more than 400 to 500 words—300 words is better, and 200 still better.

The public service corporation should not withhold from the newspaper man legitimate news matter which he is seeking.

Let the newspaper men feel that they are welcome to call whenever they have a reason, and few will take up time unless they think you have something to say that will help them. They are going to protect you if there is an expression of friendliness and frankness. Of course, there are rare instances where this policy will prove a mistake, but ordinarily it will be very effective.

Toledo Foundry Finds Central-Station Service Economical.

The Toledo Steel Casting Company, Toledo, O., which consumes monthly about 40,0000 kilowatt-hours of energy from the Toledo Railways & Light Company has adapted its entire foundry work to the electric drive, in which 15 alternating-current motors of 300 horsepower are operated at 440 volts. The largest motor, 100 horsepower, drives a 590-cubic foot air compressor, supplying compressed air for chippers, hammers, molding machines, sand blasts and rammers. The high-pressure converter blower, the Root type, is driven by a 75-horsepower motor; blast for a cupola furnace is supplied by a motor-driven blower, both being belt-connected. The four emery swing grinders are operated through a line shaft by a 20-horsepower motor; and six stationary grinders are run in a similar manner by a 10-horsepower motor. Direct current is produced by a 15-kilowatt motor-generator set, supplying power to seven direct-current motors for overhead cranes and other purposes. Recent improvements put in consist of industrial trackage on the premises, and electrically operated sand mixers and auxiliary machinery.

The installation of an electric furnace is under consideration.

Improvements Being Made by Metropolitan Edison Company.

The Metropolitan Edison Company of Reading, Pa., is about completing the erection of a new pump and heater house at its West Reading Power Plant. The building will contain machinery for handling the water that is used in the boilers.

Pumps have a capacity of 1200 gallons per minute, will lift the water from the Wyomissing Creek which flows nearby, and feed it to the heaters which have a capacity of 20,000 boiler horsepower. The heated water is then pumped to the boilers whose steaming efficiency is thereby greatly increased.

The Metropolitan Edison Company has been making a number of other notable improvements to its plants and equipment among them being the installation of a new 1500-kilowatt rotary at its South Seventh Street distributing station. This is intended to relieve the heavy demands of the street-railway service during rush hours.

Making It An Electrical Christmas in Louisville.

Louisville newspapers of Sunday, December 9, contained full-page, co-operative advertisements, signed by eight of the leading electrical appliance dealers, urging Louisville to "Make it an Electrical Christmas." The argument was President Wilson's statement that "Now is the time for America to correct her unpardonable fault of wastefulness and extravagance." It drew from this text the suggestion that useful presents should be given and lists twenty electrical items for a man, eight for the home and twenty-one for the womenfolks. Decorations were electrical and attractive. The eight houses participating in the advertisement were the Childers Electric Company, the Gas & Electric Shop, the James Clark, Jr., Electric Company, the Home Electric Company, the Marine Electric Company, the Henry J. Rueff Company, the H. C. Tafel Electric Company and the Harry I. Woods Company.

President Wilson has said:

"Now is the time for America to correct her unpardonable fault of wastefulness and extravagance."

HEED his message in this year's gift giving. These are serious times: give only serious—sensible—worth-while presents.

Buy wisely; give wisely; give *useful* gifts *practical presents*—which will *endure* —will *last*—will *serve.*

"Give Something *Electrical* This Christmas"

Electrical Gift-Hints For "Him"

Hints For Home Helps

Electrical Gift-Hints For "Her"

CHILDERS ELECTRIC CO.

GAS AND ELECTRIC SHOP

JAS CLARK JR. ELECTRIC CO.

HOME ELECTRIC CO.

MARINE ELECTRIC CO.

HENRY J. RUEFF CO.

H. C. TAFEL ELECTRIC CO.

HARRY I. WOODS CO.

Full-page Co-operative Newspaper Advertisement Used by Louisville Dealers.

Fort Wayne Company Reports Substantial Increase in Business.

The light and power department of the Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind., reports a steady increase in power and light business for 1917, and the light fixture and household appliance branch has shown steady gains. The sales of electric stoves, of which the several kinds are handled, show a good trade in a community in which many gas stoves are used. Special efforts have been made on washing machines, resulting in a satisfactory trade. C. B. Hart, superintendent of power and light department, has a number of skilled salesmen in the power, lighting and appliance branches.

Contracts for power have been made with the Pennsylvania Company for the use of 5500 kilowatts per day on shop tools in its new shops at Fort Wayne. It still uses direct-current power, produced at its own plant, in the older railroad shops. The central-station power arranged for is alternating current. Another power contract recently made is for supplying the new General Electric shops at Fort Wayne with energy amounting to about 12,000 kilowatt-hours per day.

New-Business Activity at Defiance.

Considerable activity in industrial power business is reported by the Defiance Gas & Electric Company, Defiance, Ohio, which supplies electric power to the cities of Maumee, Perrysburg and Defiance. Its power station is at Maumee, in which 2000 horsepower is produced by water-driven generators, and 3000 horsepower by steam-driven generators. The hydroelectric equipment comprises two Allis-Chalmers and one Leffel water wheel, driving three Allis-Chalmers horizontal generators; the steam equipment consists of four Heine water-tube boilers, of combined capacity of 1800 horsepower; two Allis-Chalmers, vertical cross-compound engines, each of 1500 horsepower which are direct-connected to two 1000-kilowatt, 3-phase, 2300-volt generators.

This company also purchases current from the Auglaize Power Company, which operates a hydroelectric plant on Auglaize River, three miles south of Defiance, the equipment there consisting of five Allis-Chalmers vertical hydroelectric units of 1000 kilowatts each. Current is transmitted from Auglaize plant to Defiance company's transformers at 33,000 volts. It furnishes power to factories requiring 3000 horsepower in motors, for the three towns, the current being transformed down to 440 and 220 volts for motor use. William P. Wallace is general manager of the company's business.

Massillon Company Opens New Offices.

New quarters for the Massillon (O.) Electric & Gas Company were formally opened on December 15, and about 2000 people visited the showrooms on that day and were shown through the new offices. The rooms were decorated with flowers, many of the pieces having been sent by friends of the company as tokens of good luck. Cigars and cigarettes were given to the men visitors and flowers to the ladies.

Many favorable comments were passed by the visitors in regard to the new offices and showrooms, and L. J. Lemen, new-business manager at Massillon, reports that the opening made a very favorable impression upon the visitors, and the cordial reception which everyone got will undoubtedly make many friends for the company.

Two Important Power Contracts Secured by Minneapolis Company.

The Minneapolis General Electric Company recently accepted contracts for new power business amounting to 705 horsepower in motors, including 310 horsepower for the Union Terminal Elevator Company, 200 horsepower for the W. P. Devereaux Company, 75 horsepower for the Shakopee mill, and 50 horsepower for the C. F. Massey Company.

The first two installations displace a private power plant of 500-horsepower capacity.

Operating

Conditions Governing the Cooling of Water for Power-Plant Purposes—Cleaning Turbines and Condensers in Service

THE COOLING OF WATER FOR POWER-PLANT PURPOSES.

Conditions Governing the Cooling of Water by Means of Spray Ponds.

Lack of space, large capacities concentrated in restricted areas, and the comparative scarcity of large quantities of water where needed, coupled with the rapidly increasing size and use of condensing apparatus on the score of efficiency are the main factors responsible for artificial as opposed to natural cooling of condensation water and of steam. At a meeting recently held by the Amercian Society of Mechanical Engineers, C. C. Thomas read a paper entitled "The Cooling of Water for Power-Plant Purposes" that presented a mass of useful information obtained only after considerable research and experimentation. The subject was considered on the basis of artificial or intensive cooling by means of sprays of water instead of from large quantities of water in pondage. The experiments were made in the power plant and with part of the equipment of the Department of Engineering, Johns Hopkins University. The pond is 35 feet in diameter and 4 feet deep and was designed for cooling the condensing water for a 50-kilowatt Buckeyemobile engine fitted with a surface condenser. Ordinarily the water is sprayed through one spray head or nozzle of the type developed by the author of the paper, although tests were made with other types of nozzles. A centrifugal motor-driven pump with a 4-inch suction and discharge was used to send water through the condenser tubes and spray head. A mercury column connected to the entrance of the spraying device was used for recording the pressures at the spray head. Wind velocity was measured by standard anemometer, and a dry-and-wet bulb sling psychrometer indicated humidity. The water circulated was measured by passing through a 10-inch weir fitted with michrometer hook gauge. About 600 tests were made altogether with various forms of spray nozzles. Amongst other things tests were made to determine the effect of placing a wire fly-screen cylinder about the spray head, it being found however that while the screen improves the efficiency under certain conditions, in general it was found hardly worth while to use it.

EFFICIENCY OF COOLING PONDS AND TOWERS.

The efficiency E of a cooling pond or tower may be expressed as the ratio between the cooling actually produced, $T_1 - T_2$, and that which would have resulted from cooling the water down to the dew-point or wet-bulb temperature T_w. Thus

$$E = \frac{T_1 - T_2}{T_1 - T_w}$$

T_1 and T_2 being the temperatures of the water before and after cooling, respectively. A perfect spray-cooling device would be one capable of subdividing the water so that evaporation would take place at T_w, and to an extent such as to lower the temperature of the remaining liquid spray to that temperature. The extent to which this is approached in practice is indicated by the figure in the tables of data.

Curves plotted for three initial temperatures of $T_1 = 98$, 105 and 125 degrees Fahrenheit, respectively, show the efficiency of the adjustable spray head with variation of capacity and pressure such as occurs during different seasonal conditions. From these curves another curve was obtained, from which the cooling range under various conditions can be predicted. This is done by finding the efficiency expected at any given initial temperature, and for any given pressure at the nozzle. Assuming a definite humidity, initial water temperature and average air temperature the range of cooling may be worked out from these curves.

Rather surprising results were obtained when comparing the efficiency of cooling of a pond where the sprayed water fell in the one instance upon a bare cement bottom of the storage pond and in the other instance upon a pond containing a normal amount of water, as shown in Fig. 2, and further tests are to be made in this connection since pond construction would be much cheapened if a bare pond were as efficient as one filled with water due to less expensive construction because of the lighter loading.

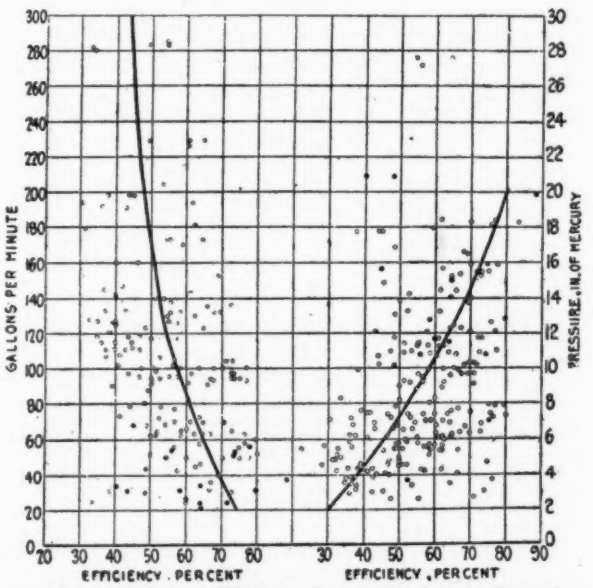


Fig. 1.—Variation of Efficiency Due to Neglect to Properly Adjust Spray Head.

It was found that a wide variation of efficiency takes place during long periods of operation when no attempt is made to adjust the spray head so as to obtain uniformly good results, as shown in Fig. 1. The tests yielding the points shown in this curve cover about one year. The heavy black circles indicate results from the non-adjustable nozzles while the others refer

to the adjustable spray head when operated under widely varying weather conditions, pressure, and temperatures of water, without any attempt to obtain high efficiency. It will be noticed that with the non-adjustable nozzles the pressures used are high and capacities very low as compared with those for the adjustable spray head.

Factors Involved in the Problem of Cooling Water.

The loss due to evaporation during a period of eight days is shown in Table 1. These data are not yet complete, but the average evaporation may probably be taken as about 2.25 per cent. This will, of course, vary with weather conditions, initial temperature of water, pressure at the nozzle, and with humidity. A large number of tests made with water at high and low initial temperatures indicate that 2 to 2.5 per cent per hour represents fairly well the average loss of water, but that it may be as low as 0.5 per cent, and in windy weather as high as 10 or 15 per cent with non-adjustable nozzles. In the case of the 40 by 60-foot pond at Sparrows Point, Md., referred to later, the loss of water per 24 hours is shown by a decrease in height of water level of about 6 inches. This corresponds to a loss of about 0.31 per cent per hour and represents average conditions at this pond. This pond is very well protected from wind, and the loss stated is probably smaller than that usually obtaining.

TABLE 1. TESTS WITH ADJUSTABLE SPRAY HEAD AT LOW PRESSURE AND AT LOW INITIAL TEMPERATURES, TO ASCERTAIN LOSS OF WATER DUE TO EVAPORATION.

Test number	1	2	3	4	5	6	7	8
Date, 1917	9-27	9-28	9-29	10-3	10-4	10-5	10-6	10-8
Duration of test, hours	6½	6½	4½	8	8	8	6	8
Hook-gage zero, ft.	1.422	1.422	1.422	1.422	1.422	1.422	1.411	1.411
Hook gage, first reading, ft.	1.593	1.592	1.592	1.577	1.571	1.597	1.598	1.511
Hook gage, last reading, ft.	1.565	1.570	1.582	1.571	1.552	1.584	1.545	1.481
Loss on hook gage, ft.	0.028	0.022	0.010	0.006	0.019	0.013	0.053	0.030
Pressure at nozzle, in. mercury	4.27	6.10	3.00	5.24	6.74	6.23	6.59	5.10
Temperature at inlet, T_1, deg. F.	86.0	83.5	84.0	73.9	79.6	81.6	70.3	80.0
Temperature from pond, T_2, deg. F.	80.4	77.8	78.0	70.6	73.6	74.3	64.6	70.2
Cooling range, T_1-T_2, deg. F.	5.6	5.7	6.0	3.3	6.0	7.3	5.7	9.8
Dry-bulb temperature, T_a, deg. F.	75.8	75.7	76.0	69.6	75.2	73.1	59.4	63.5
Wet-bulb temperature, Tw, deg. F.	66.6	68.2	66.0	57.1	62.0	61.9	50.1	56.5
Depression, T_a-Tw, deg. F.	9.2	7.5	10.0	12.5	13.2	11.2	9.3	7.0
Humidity, per cent	62	70	60	46	47	53	53	65
Loss of water,[1] per cent per hour	2.49	1.99	1.30	0.483	1.59	0.934	4.99	4.11

[1]Average loss of water (8 days), per cent per hour, 2.23.

The average efficiency for the 8 days covered by the above tests is 32½ per cent, and this is seen to correspond with the 6-in. pressure curve (extended) in the T_1 and efficiency curves given in the paper. With such low initial temperatures and pressures this represents the efficiency and cooling range to be expected. The initial temperature varied from 70 to 86 deg. and the air temperatures from about 60 deg. to 76 deg.

The power required to circulate the water is shown in Fig. 3 as watts per gallon per minute per degree of cooling from varying initial temperatures. In order to test the accuracy of this curve experiments were made on a pond at Sparrows Point, Md., which is equipped with two sets of nozzles, either of which may be used. One set consists of 42 non-adjustable, spiral-core nozzles, and the other set of 12 of the adjustable spray heads described in this paper. The power required with the adjustable spray heads at Sparrows Point is shown by the point so marked in Fig. 3, the other points being from the Johns Hopkins pond. From this curve the power required to circulate the water in a given case can be estimated, to cover specified temperature and capacity. The power appears to be practically independent of the type of spraying device used. The average power required to drive the pump may be calculated from the following equation representing the curve drawn through the experimentally determined points in Fig. 3:

$$P = \left(\frac{100}{T_1}\right)^{32.3}$$

where P = power of the pump motor in watts per gallon per minute per degree Fahrenheit of cooling, and T_1 = initial temperature of the water to be cooled,

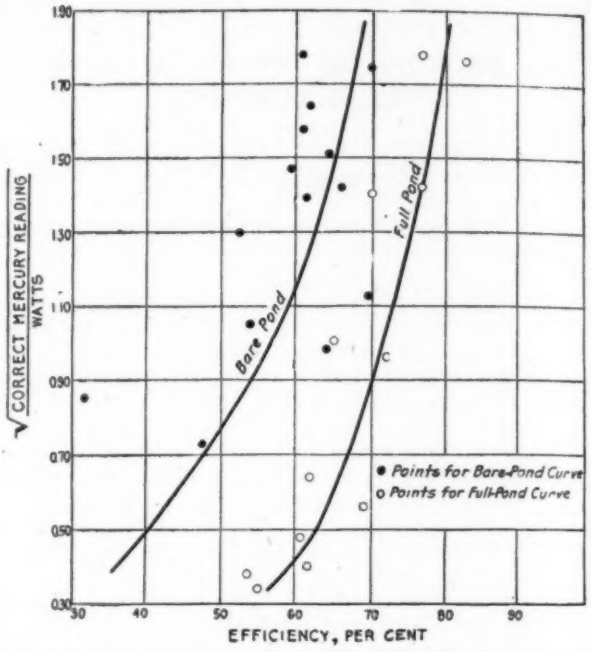


Fig. 2.—Efficiency With Water Falling on Bare Cement Pond Bottom and With Pondage at Normal Water Level.

deg. Fahr. (not absolute temperature). The cooling seems to be principally dependent upon the energy put into forcing the water through some suitable spraying device, and given the requisite energy a great variety of forms of nozzle would yield about equally good results. The operating advantages of the adjustable spray head and its large capacity greatly facilitate keeping the heads clean without shutting down to clean them. It also permits regulation of the spray to suit weather conditions and to minimize loss of water and inconvenience to the nearby buildings due to driftage in windy weather. The amount and cost of piping are comparatively small for the adjustable spray head, since each one will handle from 150 to 250 gallons per minute. In general, each adjustable spray head will handle the condensing water for a 50 to 75-kilowatt plant.

The height of spray nozzles above the surface of the pond has an important effect upon the cooling of the water. Experiments made not only in the small pond, but in three larger installations, have shown that the nozzles should be kept as low as possible. In the experimental pond heights from 8 feet down to 3 feet have been used, and in larger ponds from 6 feet down to 3 feet. A loss of several degrees, perhaps 8 to 12 degrees, results from placing the nozzles high above the pond, which was at first done because it was thought that the long path of the water through the air would result in correspondingly greater cooling. This is not borne out by experience, however, and is probably due to the following combination of circumstances: First, a given pump, placed in a certain relation to the surface of the pond, will deliver a smaller

amount of water to a high level than to a lower level, and this smaller amount will leave the condenser at a higher temperature than did the larger amount of water; second, with a given amount of power at the pump, less energy will be available for breaking up the water if the nozzle is placed high than if it is placed low, and it appears that minute subdivision of the water is more important than is a long path through the air. The higher initial temperature of the water, combined with the smaller amount of energy available for atomizing, results in a higher final temperature than would be found if the nozzles were placed more nearly on a level with the pump. The effect of wind velocity upon the cooling range is shown in a series of related tests by curves for initial temperatures of 98, 105 and 125 degrees Fahrenheit, respectively. Spraying upon a series of superposed inclined cement plates was tried and the resulting cooling ranges are shown as compared with the cooling obtained without plates. As when spraying upon the bare bottom of the pond, the plates seemed to produce comparatively poor results, but further tests might well be conducted to test this out further.

The cooling range as effected by the amount of water sprayed by a given adjustable spray head is shown by curves. As the spiral opening is made wider the degree of atomization and resulting cooling are of course reduced. This has its advantages, however, as in windy weather very good cooling can be obtained when spraying a very large amount of water per nozzle, and loss of water due to windage can be greatly reduced. The capacity of the adjustable spray head as affected by pressure at the spray head and by width of the spiral opening is also shown.

It has been found to be very difficult to take account of all the variables involved in the problem of cooling water, and perhaps no one formula will cover the matter completely. It is hoped that further investigation will serve to define the effect of humidity and wind velocity and some of the other variables, and that this paper may perhaps stimulate others to do more complete work than the writer has been able to accomplish.

It has been somewhat surprising to find that very

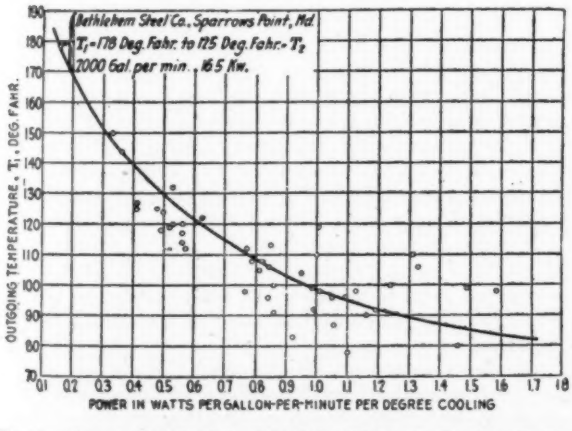

Bethlehem Steel Co., Sparrows Point, Md.
T1-178 Deg. Fahr. to 175 Deg. Fahr.-T2
2000 Gal per min., 165 Kw.
OUTGOING TEMPERATURE, T1, DEG. FAHR.
POWER IN WATTS PER GALLON-PER-MINUTE PER DEGREE COOLING

Fig. 3.—Power Required to Circulate Water in Cooling System From the Various Initial Temperatures.

good cooling effect frequently obtains in very humid and even in rainy weather; and also that cooling effect seems to bear no direct relation to humidity. The cooling effect seems to depend largely upon conduction of heat from the air, and to vary directly with the fineness of subdivision of the water particles.

The author's adjustable spray, which is shown, consists of a cast-iron supporting base containing the water-entry opening and carrying a 3¼-inch outside-diameter bronze tube in which is cut a spiral opening of coarse pitch. This opening is cut with a tool placed at an angle of about 60 degrees with the axis of the tube so that the water is thrown upward at this angle. The spiral tube is held between the base and a cap which fits the top by means of a central bronze stem which passes down through a close-clearance bushing in the base. This stem is movable and is operated by a bell crank having an extended vertical arm giving accurate control of the position of the stem. The result of the motion is to either increase or decrease the fineness of the film of water as it leaves the spray head. When the head is in operation the water discharges in a continuous sheet in a direction inclined upward, due to the angle of the spiral opening. As the water film spreads, its diameter increases and the film becomes thinner till finally the surface tension is overcome and the sheet of water breaks into either a uniformly fine spray, a mist or a large number of small drops, depending upon the adjustment of the spray nozzle. Spraying a liquid as the result of the spreading of a film of water until it breaks into mist or spray or fine drops is particularly applicable to low-pressure work, and as will be noticed in the paper, the pressures employed are relatively low, being between 5 to 8 inches of mercury. An exceedingly fine spray is obtained at 10 inches pressure, while generally a pressure of 8 inches mercury suffices, although the higher the pressure the more extensive will be the cooling for all forms of nozzles.

In conclusion it is interesting to consider some other methods of cooling, and compare the results with those obtained from spray ponds. The simplest method is to discharge the water through a single pipe to a pond of sufficient area so that the water will be cooled by contact with the atmosphere on the surface of the water. Such a pond must be very large in order to obtain satisfactory results, and in order to reduce the area required it is necessary to add some device by which additional contact of the water with the atmosphere is obtained. Probably the most completely controlled means for cooling water in large quantities is

TABLE 2. RESULTS OF TESTS OF COOLING TOWERS.

No. of test.	T_1	T_2	T_1-T_2	T_a	Humidity, per cent.	T_w	T_1T_w	Efficiency.	Draft.	Gal. per min.	Gal. per min. per sq. ft.
C. H. WHEELER CO. COOLING TOWERS.											
1	83	68	15	65	65	58	25	0.600	Natural	3600	2.00
2	124	88	36	82	60	72	52	0.693	Natural	400	1.39
3	130	90	40	82	78	76.5	53.5	0.748	Natural	850	1.42
4	144	80	64	89	49	75	69	0.928	Forced	480	2.81
5	82	73	9	75	37	59	23	0.391	Forced	5000	4.00
6	108	74	34	86	44	70	38	0.895	Forced	1400	2.47
JENCKES SPINNING CO. OPEN-TYPE TOWERS.											
1	85	72	13	64.5	65	58	27	0.482			
2	70	52	18	25	61	22	48	0.375			
3	72	60	12	57	40	46	26	0.462	(Wind 10 mi. per hr.)		
4	66	48	18	37	60	32.5	33.5	0.538			
5	86	68	18	74.3	60	64.8	21.2	0.850			

found in the forced-draft cooling tower, which is particularly effective because of the regularity with which an air current is brought into contact with water spread out and dropping from properly arranged surfaces. The cost of installation and operation of a forced-draft tower, however, is very much greater than for a spray pond. The newly developed spray head provides for control of the system in a manner which, while somewhat less complete than in the case of a cooling tower, yields results which compare very favorably with those from the tower. Table 2 shows results obtained from tests of several cooling towers, some having forced draft and some natural draft.

CLEANING TURBINES AND CONDENSERS IN SERVICE.

Simple Methods Enable Units to Remain in Service Where Shut-Down Cleanings Neccessitate Interruptions and Lost Capacity.

By H. E. Wagner.

The cleaning of steam turbine blades and guides and condenser tubes is always a rather lengthy process and requires taking the unit out of service for varying and often uncertain lengths of time. Often a unit can be ill spared, even though it is realized that its efficiency suffers because turbine blades are dirty and condenser tubes covered with a heat-insulating film. Operating economies are thus sacrificed. Some companies have tried cleaning their turbine blades and condenser tubes, or either, as the case may be, fairly frequently while in service, instead of waiting and even in addition to definite periodic overhauling. Although in some instances success has not followed, pleasing success has in other cases proved the desirability of attempting measures that tend to prevent instead of relying upon periodic cure. Such practices assume added importance in these times where all equipment is hard pushed in meeting the demands upon it, and where every effort is made to keep every machine in service. For these reasons, though the cost of general overhauling should always be considered, a description of how turbine blades and condenser tubes may often be kept clean and the time for shut-down delayed may be useful.

In one instance a 2000-kilowatt mixed pressure turbine was operating in a station containing a number of high pressure units, the mixed pressure unit operating according to the conditions of the load and plant. There is usually a certain amount of oil and foreign matter leaving the stages of any turbine that passes into the mixed pressure unit, to adhere to the blades and guides, to cause erosion, corrosion, loss of efficiency and often unbalance. The same applies to the condenser tubes. Instead of carrying out periodic cleanings by shut-down it was decided to install a system of cleaning that would accomplish the same purpose but to lesser degree with the machine in service, or out of service for only a few hours, such as is possible at least once a month in practically every station.

The turbine was treated about every seven days. A pipe had been installed across the steam inlet of the mixed pressure unit, the pipe being made into a nozzle with many holes in it about the size of a pin prick. The nozzle connected with some 50 gallons of kerosene under pressure and controlled by a valve. With the machines in service, and with steam on the valve controlling the cleaning nozzle opened, kerosene was carried into the turbine along with the steam. With the steam it impinged against the metallic parts of the turbine, thus tending to loosen up scale that might be forming.

The arrangement was a little more complicated in the case of the condenser. A number of nozzles were installed in the condenser casing at equal distances. These nozzles were connected to several pipes on the outside of the casing, which in turn met in a common header. This header was connected to the condenser circulating pump through a valve. About every two months or so the unit would be shut down. A barrel of kerosene would then be poured into the handhole in the condenser. The discharge pipe in the hot-well pump leading to the heater was then closed and the valve between pump and header opened. The hot-well pump is then started up and the kerosene circulated through the cleaning system piping, through the nozzles and into the condenser. This treatment is continued for about three hours when the kerosene is drained off and with it the sediment from the condenser. After standing for an hour or two, the sediment and suspended matter precipitate, and the cleaner surface kerosene is drained off for use again in the turbine.

Cleaning out condensers and turbine blades is always a lengthy undertaking where cases have to be removed and each tube or blade treated separately. Any scheme by which the time for doing this can be delayed is of value and the longer the time between shut-downs, the greater the direct gain since it leaves the capacity represented by the machine available for use, and thus also enables it to earn bigger return upon the investment. These are important items, but the fact that with the above method of cleaning the machine can be placed back into service on extremely short notice should it be necessary to do so, is greatly in its favor, especially.

In the treatment of boiler scale kerosene is usually understood to be more useful when the scale and boiler heating surfaces are dry. However, the suspended matter impinged against turbine blades and adhering to condenser tubes is of a different variety. The writer believes a discussion as to the value of the above practice would be of interest, and an expression as to whether where this scheme has been attempted the results obtained have justified the attempts. The condition of the mixed pressure and low and exhaust pressure turbines where the steam is received after passage through other turbines is particularly favorable for the collection of air and dirt of various kinds that rapidly cause loss of efficiency in turbine and condenser. Even though the above mentioned method of cleaning is not as effective as a thorough overhauling, the fact that the final shutdown can be delayed and the influence of dirty steam be reduced makes it worthy of careful consideration and experimentation at this time.

Dollar Value of Heated Air.

By W. F. Schaphorst.

Among some of the more common ways of saving coal by using it more usefully are such practices as using feed-water heaters, the use of more efficient engines and turbines, the use of economizers and more efficient transmission systems. One of the practices now finding increasing favor in the way of saving heat is that of using warm air for the furnace supply. For example, the air used to cool generators by absorbing their heat instead of being allowed to go to waste, where the heat carried by it represents a dead loss, is now often used to increase the temperature of the furnace fire by being passed through ducts from generator to furnace.

Under average conditions, and allowing for excess air, each pound of coal requires about 18 pounds of air for complete combustion. Inasmuch as 0.24 British thermal units are required to raise the temperature of 1 pound of air 1 degree Fahrenheit, it is quite evident that much of the heat value of a pound of coal is lost in bringing the temperature of the cold air up to the temperature of combustion. For each degree 4.32 B. T. U. are lost, allowing for 18 pounds of air per pound of coal. If the heat value of 1 pound of coal is 10,000 B. T. U., the heat lost in this way is 4.32 per cent per 100 degrees.

It is now evident that this preheating of furnace air deserves careful consideration in these days of high coal costs and scarcity. To aid the reader in determining the cost of using cold air or the saving due to the use of warmed or even heated air, the accompanying chart has been gotten up, showing directly in dollars the saving, based upon various cost and heating value of coal. For example, if the heat value of a coal is 10,000 B. T. U. and the annual coal bill amounts to $10,000, what would be the saving due to preheating the furnace air 80 degrees Fahrenheit?

Run a line from column A, which represents heat units, in the present instance at 10,000 because that represents the heat value of the coal under consideration to the $10,000 mark in column B. Note the position where this diagonal line intersects with the line marked C. From the point of intersection of the

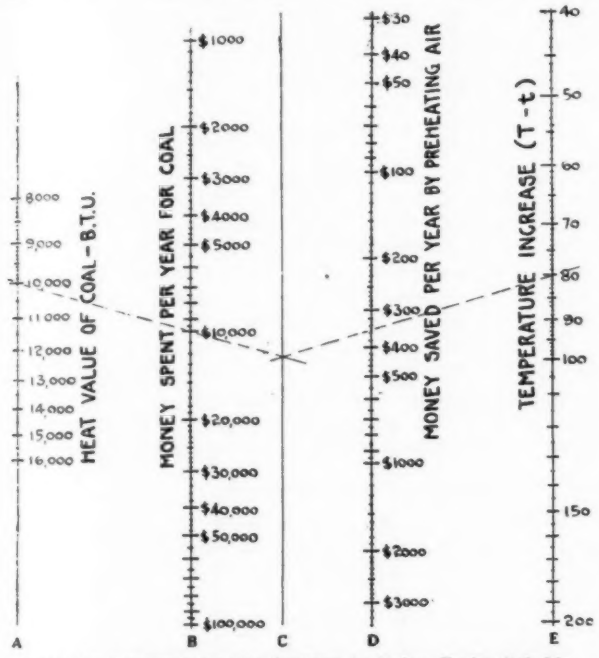


Chart for Determining the Savings in Using Preheated Air.

diagonal with C run another line over to column E to the figure 80, which is the extent of the proposed preheating of the air. Now, referring to the intersection of this diagonal line with that of column D it will be seen that the value $350 is approximately indicated. This means that the saving in money value of heat conserved amounts to almost $350 annually.

Against the money saved by burning less coal for a given amount of heat must be considered the cost of ducts, fans, etc., for guiding the air to the fuel bed. When the above saving equals the interest and maintenance charges upon the equipment and apparatus necessary to preheat the air, there is no saving in operating expenses. When the saving due to preheated air exceeds the cost of using it, the difference is a direct profit. The above method of saving heat, and therefore money, is however worthy of careful consideration because of the saving that is sometimes possible and even more care because the saving may only be very small after all factors have been taken into consideration. The value of coal above considered is the coal used in active combustion and not that due to banked fires.

Coal is too expensive now not to economize it in every way. However, immediate economies should be accomplished.

Fuel-Saving Posters Issued Weekly by Doherty Company.

Fuel-saving posters are being issued each week to Doherty properties by the New York office, and they are designed to be hung in places where they will attract attention and emphasize the necessity of saving fuel. The first poster of the series was a plea for fuel saving and has already been distributed among the properties. Poster number 2, which will be issued next, points out twenty things in a power plant where waste is possible. Twenty potential waste places are:

1. Too many boilers in service.
2. Holes in the fire.
3. Fires too heavy.
4. Improperly banked boilers.
5. Too much fuel in the ashes.
6. Failure to operate boiler dampers.
7. Irregular steam pressure.
8. Safety valves blowing.
9. Air leaks in the boiler settings.
10. Scale in the tubes.
11. Soot on the tubes.
12. Leaky baffles.
13. Stokers or grates out of repair.
14. Leaky blowoff valves.
15. Steam leaks of any kind.
16. Dirty feed-water heater.
17. Bare steam pipes.
18. Low vacuum.
19. Turbine blading worn.
20. A dirty plant causes fuel waste.

Illinois Central Stations Ask Rate Increases.

A number of central-station companies in Illinois have filed petitions for an increase in lighting and power rates. The petition of the Cairo Gas Company to increase its rates has been continued until January 3, 1918. The Clinton Gas & Electric Company, at Clinton, a subsidiary of the Illinois Traction System, filed a petition recently with the Illinois Public Utilities Commission asking for an increase in rates for heat and electric light. The Lincoln Water & Light Company, at Lincoln, has asked to be permitted to increase light and power rates, and the Monmouth Public Service Company, at Monmouth, also asked permission of the Illinois Public Utilities Commission to raise heating and lighting rates in Warren County.

Nashville to Conserve Coal.

Elimination of street lights in portions of Nashville, Tenn., is proposed by J. O. Tankard, city commissioner of lights, as a measure by which the coal consumption of the municipal lighting plant may be reduced. Lights along the white way sections will be materially reduced, as will lights in and around public buildings, while it is proposed to dispense with street lights altogether in residential districts on moonlit nights. If the coal situation continues serious it is possible that lights will be dispensed with altogether in some of the residential districts. The city has advertised twice for bids for a coal supply for the municipal lighting plant without obtaining any bids.

The same electrical conductivity as that of platinum is claimed for a metal alloy consisting of gold and silver with about four per cent of osmium added to harden the metal and to raise its melting point. It is suggested for contact points by Hugh S. Cooper of Cleveland in U. S. Patent No. 1,248,621.

Construction

Minimizing Static Troubles—Floodlights in Series—Constant-Speed Motor—Glass Works Installations—Contractors' Doings

Simple Way to Minimize Static Troubles.

By A. Gemmell.

The cold, dry days are here again and with them the almost endless troubles from static electricity. Even in ordinary weather in case of telegraph or other signaling lines running along or near high-tension lines, trouble from static is frequently met with. In the case of signal circuits this is very annoying, as the bells will tingle at odd times, and make it a very hard matter to receive or send messages on the lines thus affected. Often electric clocks are affected and the trouble is blamed onto the apparatus being out of adjustment, or being poorly maintained.

I found that a simple remedy can often be used by placing a certain amount of resistance in series with

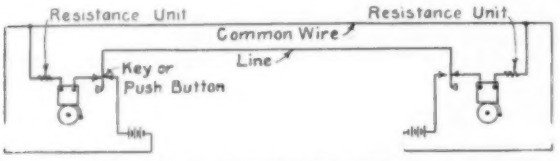


Fig. 1.—Resistances on a Return-Call Bell Circuit to Check Static Troubles.

the line, the resistance being placed at definite points so that under favorable conditions it will cut down the static trouble 90 per cent or more. In the accompanying illustrations are shown some cases where this method has been successfully employed. Fig. 1 shows a return-call bell circuit with resistances connected in the line. This will stop the static from interfering with the bells. It must be noted that the resistance units are connected on the common sides of the bells. Fig. 2 shows resistance units connected in a simple telegraph line. If resistance units are cut in at several places along the line, especially those where the static has mostly been picked up, the trouble is very greatly reduced. Care must be taken when resistance units are put in, so as not to have too much resistance, as this would reduce the line current too much and cause an excessive amount of battery to be required.

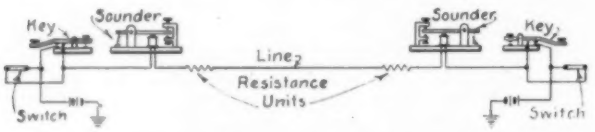


Fig. 2.—Resistances on a Grounded Telegraph Line to Minimize Static.

Fig. 3 shows a very simple form of resistance tube that I have found to give very good results. It is very compact and durable and can be made in the form shown for various values of resistance. Fig. 4 shows a very convenient adjustable resistance unit that can be easily made in a short time. The diagram shows that its construction is very simple. Although German silver wire is shown, any good high-resistance wire that will stand the current used is suitable. Such an adjustable resistance can be used permanently in some places, but will be found best suited for making tests

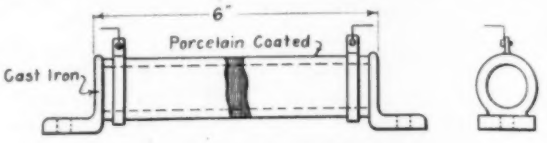


Fig. 3.—Simple Resistance Unit.

to find out the proper amount of resistance to put on the circuits affected. The resistance wire can be wound closely around a lead pencil, or similar rod, and then the pencil drawn out, leaving thew ire in the form of a loose coil, which is put on the board as shown. If a definite length is measured up for resistance for coiling it is possible to make each section of the rheostat indicate just how much resistance is necessary. This test rheostat can be made as large as desired to suit the requirements. No. 22 or 24 gauge wire is found to give good results for this purpose. Such a test set is also very useful for other purposes,

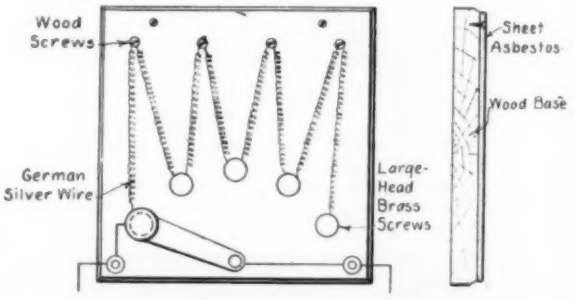


Fig. 4.—Simple Adjustable Rheostat.

such as on low-voltage lighting circuits, and can be used for many places where an adjustable resistance is desired.

Wiring Floodlamps in Series.

By C. W. Young.

Recently I had several floodlights to install and, having only 220-volt circuit available, wired them in series. After putting them in service, I was continually bothered with lamps burning out owing to current surges in the line serving the property.

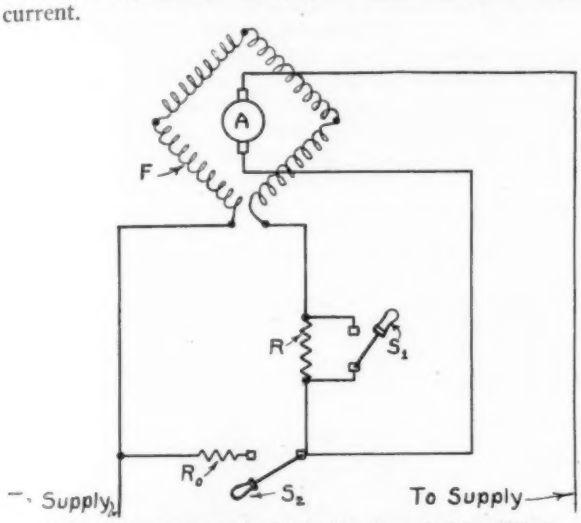
I have been able to reduce our lamp loss from this cause considerably by placing in series with the lamps about 1000 feet of No. 8 wire, leaving the wire in the coil as shipped. This seems to act like a choke coil and minimizes the effect of the surges. Since doing this I have lost two lamps in the past two weeks, compared to two or more almost every night before using the choke coil.

To Secure Constant Speed in a Series Single-Phase Motor.

By H. E. Weightman.

For the purpose of making a series, single-phase, alternating-current commutator motor keep a practically constant speed, similar to a direct-current shunt motor while running, the following method can be used.

Referring to the diagram, A is the motor armature, F the field winding, R a resistance capable of carrying one-tenth normal full-load line amperes, R_0 is a resistance capable of carrying continuously full-load current.



Wiring for Constant-Speed Series Commutator Motor.

To start, close switch S_1 and open switch S_2 and connect across the supply circuit. After starting, close switch S_2 and open switch S_1 simultaneously. This operation can be simplified by making a combined switch or controller.

The resistance R should be of such value relative to R_0 as to cause 7 to 10 per cent of normal full-load field excitation in the motor field. R should be so proportioned as to allow the armature to take full-load current and will be approximately equal to the series-field resistance.

Large Electrical Installations in West Virginia Glass Works.

The La France Electrical Construction & Supply Company, Toledo, Ohio, has practically completed the factory wiring and the installation of power equipment in the plant of the Libby-Owens Sheet Glass Company, at Charleston, W. Va. The wiring for power and lighting is carried in Sherarduct conduit made by National Metal Molding Company, of which five carloads were required. The three General Electric 550-kilowatt generators installed are individually driven by direct-connected Cooper gas engines for which natural gas obtained on the premises is used. The current produced is supplied to about 75 motors of a combined capacity of 1000 horsepower for driving glass machines, blowers for furnace draft, sprinkler system, pumps, conveyors, elevators and other machines.

Under this contract of the La France company, which amounted to around $75,000, the Libby-Owens company furnished the principal part of the equipment.

The La France company now has in course of installation the wiring and power equipment in the new plant of the Owens Bottle Company, in the same locality. This plant is to be equipped with three gas engines, each to be direct-connected to an 850-kilowatt Westinghouse generator, and about the same number of motors as were required in the plant first mentioned. This contract amounts to about $100,000, and, as in the other case, the glass company buys most of the equipment. Both plants were designed by the DeVore-McGormley Company, Toledo, for which C. H. Van Tine is mechanical and electrical engineer.

Among the Contractors.

Gleason Electric Company, Tacoma, Wash., is establishing new quarters to cost $2000 at 1113 South K Street. The new quarters, which will be modern in every respect, are being installed by Leo Kellogg.

Toledo Armature Works, 932 Collins Street, Toledo, Ohio, recently answered an urgent call from the River Raisin hydroelectric plant, near Monroe, Mich., to place new coils in one of its generators. This is a partnership concern composed of H. P. Myers, Louis J. Miller and Roy Pittman, and has done an extensive business in building, repairing and general maintenance of motors and generators.

Electrical contractors in many cities of the country are busy just now with installation of burglar alarms on a much larger scale than ever. Numerous bank robberies, both by day and night, have aroused the banking and other business interests to the need of reliable closed-circuit alarms. This means that contractors who have had experience in installing reliable systems are finding opportunities for business at what would otherwise be a rather dull time.

Edmunds Electrical Construction Company, Fort Wayne, Ind., has the contract for light and power wiring of the large new buildings being erected at the Fort Wayne Works of General Electric Company, including the installation of control panels throughout. The Edmunds company is also doing the wiring in the new Y. M. C. A. building at Fort Wayne, and will install 18 motors required for elevators, vacuum cleaners and ventilating fans. This building is to cost $500,000.

Russell & Company, electrical contractors, 56 West 45th Street, New York City, have been awarded the contract for the electrical work in the new building at 70 West 45th Street for A. R. Boyd. Henon & Boyle, of Philadelphia, Pa., are the architects and engineers. This building will be used as a store and studio building. The work is being installed with rigid conduits for the feeders and BX cable for the branch circuits. The lighting fixtures will also be furnished by the Russell company.

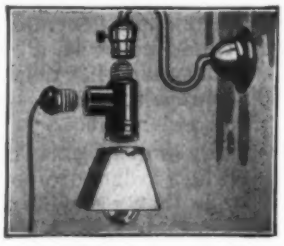
B. D. Douty, Defiance, Ohio, electrical contractor and dealer in electrical appliances and supplies, has in hand the electric wiring for lighting and power in the second and third stories being added to the building of the Defiance Screw Products Company. He is installing 60 four-light ceiling clusters on the two new floors. He recently installed General Electric motors amounting to 200 horsepower on the first floor for shop machines. The improvements referred to will require a number of additional motors on the second and third floors. Other work under contract by Mr. Douty consists of wiring the Tenzer Science Hall on Defiance College campus, the building costing $50,000. He handles Standard electric stoves, made in Toledo, and has placed a number of them in service.

New Appliances

New Types of Sockets—Cable-Junction Box—St. Louis Alternating-Current Motors—Welding Panels—Unbreakable Pipe

Ajax Plural-Plug Socket.

The need for a convenient means of attaching flat-irons, curling irons, fans and other electrical devices without depriving the use of the only light commonly available in the room has brought about the development of various so-called current taps. A modification of this type of device is illustrated herewith. It is known as the Ajax plural-plug socket and as shown is a plug with two sockets, one below and the other at



Plural-Plug Socket.

the side. It is made of hard-rubber composition with a highly finished black finish. It is durably constructed and so simple that it cannot get out of order easily. The lamp is left in the original position and a shade may be attached, if desired. The device is made by the Central Telephone & Electric Company, 3102 North Eleventh Street, St. Louis, Mo.

General Electric Threaded Catch Socket.

A threaded catch socket designed in such a way that it can be easily assembled and so that the shell cannot be pulled apart by many times the strain to which it will be subjected in service is now being made by the General Electric Company, Schenectady, N. Y. The parts of this socket are shown in the accompanying illustration. Lugs on the cap fit into the body of the shell and the threaded ring shown at the top of the illustration holds the cap firmly in place.

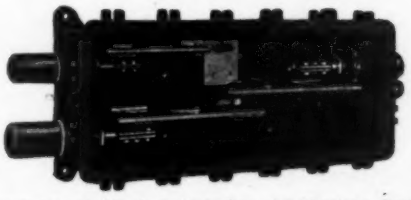
Threaded Catch Socket, Showing Parts.

This improved socket design is offered in place of ordinary types where the threaded feature mentioned is essential. This type of socket is made in key, keyless and pull designs and in locking types, key and keyless. The shell of the key type is shown herewith.

Sectionalizing Cable-Junction Box.

A cable-junction box specially designed for electric railway service by the Standard Underground Cable Company, Pittsburgh, Pa., is shown in the illustration herewith. Where feeder circuits are installed underground, use of this box makes possible the disconnecting and sectionalizing of different parts of the circuit while alive by simply opening one or more of the quick-break knife switches.

The box is mounted on the wall of the manhole and is rendered perfectly waterproof by means of liberal gaskets at all points. The cables enter the box through nipples which are mechanically connected to the lead cable-sheath by a wiped soldered joint. The main feeder cable passes into the box through the nipples shown in the illustration at the right-hand end and at the lower left-hand corner. The nipple shown at the



Sectionalizing Cable-Junction Box for Electric Railways.

upper left-hand corner is for the side-feed tap leading to the trolley wire.

The box is designed for use with main feeder cables up to 2,000,000 circular mils and for side-tap feeders up to 500,000 circular mils. The two quick-break switches in the main feeder circuit each have a current-carrying capacity of 1000 amperes and that in the side tap circuit a capacity of 400 amperes. All live parts in the box are mounted on non-inflammable insulating material and separated by ample air gaps.

A very important advantage in the design of this junction box is the patented bimetallic nipple. The rigid portion of this nipple is brass and the malleable portion lead. The wiped joint is therefore made between the lead of the nipple and that in the cable sheath, which method requires much less heat and less skill than in making a similar joint between brass and lead. The nipple is also designed to permit all cable connections to be made away from the box where

there is more room to work and no metal wall to conduct the heat from the parts to be joined. After all connections are made to the cable the nipple is inserted and clamped in position by means of a nut on the inside of the box. The joint between nipple and box is made waterproof by liberal gaskets inside and outside.

A New Line of Well Built Alternating-Current Motors.

The St. Louis Electrical Works, St. Louis, Mo., have just finished complete development of a full line of alternating-current motors. They furnish single-phase motors in ten sizes from one-eighth to two horsepower, and polyphase motors in ten sizes, from one-half to ten horsepower. These motors are for a frequency of 60 cycles. The speed is 1750 revolutions per minute. A speed of 1200 revolutions per minute can be furnished in the two and three-phase motors. Any of the frame sizes can be furnished for frequencies of 50, 40, 30 and 25 cycles.

Good operating characteristics, simplicity and ruggedness have been the chief ideas of the designer, E. Ballman, throughout the whole line. The frame construction is of the skeleton type and so put together to give excellent ventilation to both the stator and rotor, and the design has been so worked out that the frames are interchangeable for both the single-phase and polyphase motors. The use of this special winding

New Alternating-Current Motor Complete.

and the proportioning of the ratio of the rotor to the stator, gives very low iron losses. The operating characteristics of these motors are very satisfactory, giving very high efficiency and high power-factors for motors of these sizes.

Ball bearings of the best grade obtainable have been adopted exclusively for the St. Louis motor. A great amount of attention was given by the designer in properly housing this bearing so as to keep out all dirt and grit of every description. The oiling arrangement provided is such that all oil that gets to the bearing has to filter through a felt washer that is used in inclosing this bearing. An oversized ball bearing to that recommended by ball-bearing manufacturers is used at the pulley end of these motors. This is only another feature showing the designer's desire to assure to users of these motors permanent operation. The ball bearing has proven itself superior in all cases to every other type of bearing when it is properly housed. This fact is demonstrated by the extensive use of same in motor-car manufacture. The ball bearing has been

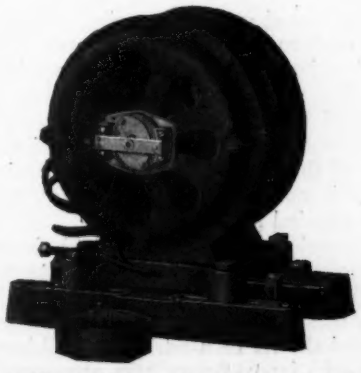
Alternating-Current Motor Disassembled.

adopted almost exclusively by the European manufacturers of electric motors. The use of ball bearings in electric motors not only assures the elimination of bearing trouble, but it eliminates a wear which is common in the ordinary sleeve bearing which wear changes the air gap between the rotor and stator, thereby affecting the operating characteristics of the motor.

The rotor construction is such that it acts as a fan for the stator and this fanning is done by the rotor bars, which extend out. This feature not only acts as a fan for the stator but this extension of the copper rotor bars radiates heat more readily from the rotor, that is, it gives the rotor much greater radiation than if the rotor bars had been cut off at the end of the iron and a fan bolted on at each end, which is common practice.

The single-phase motors are only manufactured up to two horsepower. The split-phase winding is used in starting and on all sizes up to and including one-half horsepower. A unique centrifugal starting device is furnished. This starting arrangement can also be furnished on larger sizes, if specified by the purchaser, otherwise a double-throw starting switch is furnished. This centrifugal starting switch is mounted outside the motor on the end plate and rotor shaft. It is completely inclosed and gives the motor all the features of a completely inclosed motor and still gives ventilation at the ends. Inside of the end plates of the single-phase motor is just the simple squirrel-cage rotor. This design gives this single-phase motor all the good features of simplicity of the ordinary squirrel-cage two or three-phase motors.

This starting device is so constructed that in breaking the contact which cuts out the starting winding, it does it with a snap. The quick break eliminates



Small Single-Phase Motor, Showing Centrifugal Starting Switch.

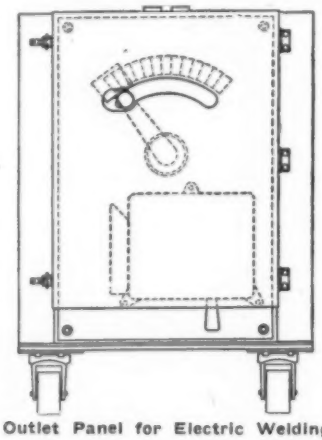
chattering or the burning of the contact points by arcing. The points used for making and breaking contact are tungsten, which assures minimum wear.

The 5, 7½ and 10-horsepower motors are furnished with leads brought out so that the motors can be started by the star-delta starting arrangement, if desired. The bringing of these leads out also permits the motor to be connected either for 110 or 220 volts.

Portable Outlet Panels for Electric Welding Service.

For an electric welding outfit to be of its maximum service, it must be so arranged that it can be taken to the work no matter where that may be located. For instance, in a railroad shop there should be outlets adjacent to each stall in the roundhouse, one or more on the washing tracks outside and others in places through the shop. In a boiler shop there should be an outlet on every other column and in a large machine shop there should be an outlet adjacent to each of the larger machines in order that work may be done in filling up blow holes and other defects on large castings with the minimum amount of crane handling.

One solution of the problem would, of course, be to locate a panel outlet of a suitable type wherever it is anticipated that electric welding might be desired. However, this is rather an expensive proposition and many electrical engineers would prefer to accomplish the same result in a simpler manner. A recently developed portable outlet panel manufactured by the



Portable Outlet Panel for Electric Welding Service.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., takes care of this situation with a minimum of expense and with all the simplicity of the familiar distributing system for storage-battery charging.

Two types of portable outlet panels are furnished, both being mounted on light trucks. They consist of a control panel mounting a handle-trip railway-type circuit-breaker having overload release with magnetic blowout, and a 13-point face plate connected to a resistor mounted in the rear of the panel. The face of the panel is protected by a metal cover through which the handles of the rheostat and circuit-breaker project. The resistor is made up of grids and is protected by a cage of expanded metal.

Type E panel is intended for metal electrode welding only, having a capacity of from 80 to 170 amperes. With this outfit one metal electrode holder and one shield are supplied. For a wider range of work a type F panel should be used. This will handle metal-electrode work from 80 to 160 amperes, and light graphite-electrode work up to 300 amperes. The outfit includes one metal-electrode holder, one graphite-electrode holder and one mask.

In installing an electric welding system using these portable panels, the best method is to place a Westinghouse arc-welding motor-generator set at some central point. Where suitable low-resistance ground connection can readily be made throughout the shop as, for instance, where metal floors or cast-iron bedplates are in general use or in a railway shop where the track system can be used, only one connector need be extended to the various receptacles. The iron floor plates may be arc-welded to each other and isolated sections tied together by an iron rod or heavy copper cable, while the track rails may be bonded by arc-welding the fish plates to the rails. Receptacles should then be provided at suitable points throughout the shop of a capacity appropriate for the service for which they are intended. These receptacles may readily be mounted outdoors, if they are provided with protection from the weather. Only single-pole receptacles and a single-wire cable to the portable panel need be provided. This cable should be of sufficient length so that the panel may be placed as near as possible to the work in order to save steps and valuable time for the welding operator. The flexible cable leading from the panel to the electrode holder should be as short as is consistent with the class of work to be done.

Where metal floors or tracks are not available, the ordinary two-wire system of distribution with double-pole outlets and two-wire cables should be provided.

Unbreakable Pipe.

In every kind or class of material manufactured no efforts or skill are spared to make it perfect, or in other words, to have it meet all requirements. Such perfection seems to have been reached in the steel pipe manufactured by the National Tube Company, of Pittsburgh, Pa. This pipe, when subjected to the severest tests, will crumple, but will not break. Real tests of the value of materials usually are made accidentally. Such a test occurred recently when a piece of 5 3/16-inch pipe, 18 feet long, a product of the National Tube Company, was stuck in an oil well and 170 quarts of nitroglycerin placed in the well and exploded, with the idea of "shooting" the well. The pipe, which remained in the well, was reduced in length from 18 to 6 feet and was badly crumpled, but did not show a single fracture. Another accidental test occurred when a string of 340 feet of 10-inch oil-well casing fell 236 feet, when an elevator let go. The thread protector on the pipe was forced over the threads and up over the pipe 12 or 13 inches and the pipe bent backward and inward, but no fracture made. A "3 in 1" section of casing, weighing 34,000 pounds, which dropped 200 feet to a bottom of limestone, in the case of an elevator letting go, telescoped the three sections, but there was no failure in the weld and the three lengths telescoped without a crack. Numerous cases might be related where this piping has proven to withstand the severest tests imposed upon it.

Multi-Catch Pull Socket and Swivel Attaching Plug.

A new General Electric Company wiring device consists of a multi-catch pull socket and swivel attaching plug with current tap. This device can be screwed into a socket and any electric portable appliance such as fan motors, piano lamp, etc., attached by means of a current tap without the loss of the light in the outlet, while at the same time the advantage of a pull socket is gained.

Trade Activities

New Plants and Buildings Opened—Calendars and Catalogs Being Distributed

Arthur Jones Electric Company, Chicago, gave an informal housewarming and dance Saturday evening, December 22, at 2837-2843 South State Street, in honor of the opening of its new plant.

Youngstown Sheet & Tube Company, Youngstown, Ohio, has issued a very attractive calendar for 1918. It is featured by twelve large two-color illustrations of as many different operations in the manufacture of iron and steel. The plates were made from photographs taken in the works of the company and are both handsome and instructive. The calendar will be sent to any address on receipt of four cents in stamps to pay cost of mailing.

Rutenber Electric Company, Marion, Ind., is distributing an illustrated leaflet showing some of its products, including stoves, among which is an electric table stove, Model No. 206, which broils, boils, steams, fries, toasts, bakes, etc. This stove may be attached to any lamp socket and is neatly made and finished, adding to the appearance of any table when in use. It is of convenient size and moderately priced. The company will supply its complete catalog upon request.

Charles A. Schieren Company, New York City, is sending out a very complete and attractive calendar for 1918, in recognition of its fiftieth anniversary. This calendar will undoubtedly be one that will be preserved by every recipient, as it contains a very interesting view of lower New York City with its many skyscrapers, including the Brooklyn Bridge and Statue of Liberty. The location of the Schieren building is graphically shown in the lower New York section. Charles A. Schieren Company, which was established 50 years ago, is widely known in electrical circles as having been among the very first to supply belting to the electrical field in the early days of that industry. Mr. Charles A. Schieren, Jr., son of the recently deceased Charles A. Schieren, who established the company, is president, and has associated with him his brothers in carrying on the business. They have branch offices in all the leading cities, with the main office and belt factory in New York City and tanneries in Bristol, Tenn.

New Marine Fixture Plant in Northwest.—One of the latest additions to Seattle, Wash., manufacturing industries is the Cooley Manufacturing Company, the outgrowth of the manufacturing business formerly done by the George R. Cooley Electric Company. For the last seven years Buxbaum & Cooley and their successor, the George R. Cooley Electric Company, have been manufacturing a line of water-tight marine electric fixtures, fittings and incandescent searchlights in connection with their contracting business. The latter company's manufacturing business outgrew its quarters and ability to handle and care for increased business offered. B. C. Dinius, a mechanical engineer of Seattle, A. G. Hale and George R. Cooley have incorporated the company and established a factory at 1772 Twenty-second Avenue South, Seattle, fully equipped to manufacture all the electrical goods formerly manufactured by the George R. Cooley Electric Company, as well as many other brass fittings. The new company will do its own casting, finishing, polishing and plating. Mr. Cooley has patents covering his incandescent searchlight and it is proposed to make these in three sizes. A number of these lamps are in use in Puget Sound boats, where they have proven very satisfactory. The Port of Seattle Commission and the City of Seattle are among the users of these lights. There is no factory on the Pacific Coast that turns out water-tight marine fixtures and it is believed that the market for this line of goods will be unlimited.

Electric Storage Battery Company Completes New Building.—Thirty years ago, in the town of Gloucester, N. J., the Electric Storage Battery Company laid the foundation for what is said to be today the oldest and largest plant in America devoted exclusively to the manufacturing of storage batteries. The first batteries made were manufactured under the name "Chloride-Accumulator" and were used for lighting and for running street-railway cars. The Lehigh Avenue Railway Company of Philadelphia ordered 1300 cells of this battery to be used in the equipment of six storage-battery cars built for operation on this road. A battery which was at that time considered a large installation, was built for use in the Provident Life & Trust Building, Philadelphia. The inherent merits of the "Chloride-Accumulator" were soon acknowledged by prominent electrical engineers, and by 1892 it began to attract the attention of the electrical field. From that year on, more and more "Chloride-Accumulators" found their place in various industries throughout the country. In 1900 the "Exide" Battery was produced, followed rapidly by the "Hycap-Exide," the "Thin-Exide" and the "Ironclad-Exide." Every one of these batteries has earned its way—has proved itself under all sorts and conditions of service. The rapidly increasing use of batteries made by the Electric Storage Battery Company necessitated frequent and substantial additions to the original plant. In 1894 the Company secured the basement and the first floor of one of the wings in the large Warden Power Building at 19th Street and Allegheny Avenue, Philadelphia. From time to time additional floors of this building and specially built structures were incorporated into the plant. These, however, very rapidly became inadequate, and in 1904 the company became the possessor of the entire group of buildings, feeling reasonably assured that it amply provided for both its present necessities and its future growth. This assumption, however, soon proved to be a fallacy. In 1911 contracts were let out for the erection of an immense six-story concrete addition to the already erected buildings. This addition at the time was the largest of its form of construction in Philadelphia. Not only have additions to the additions been made, but an entire new series of buildings located on the opposite side of Allegheny Avenue and connected with the parent works by a covered bridge, have been erected. While awaiting orders made speed of construction extremely necessary, this feature was not allowed to interfere with the aims of the builders in erecting the new building. It was put up slowly and carefully and is an imposing monument to one of the most important industries in the world today. The buildings of the Electric Storage Battery Company, as they stand at present, contain over 20 acres of floor space, yard space covering four acres. Tracks from two railroad lines run directly into the yards of the works.

New Building of Electric Storage Battery Company at Philadelphia.

Latest Approved Fittings

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Attachment Plugs, Fuseless.—Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins "Spartan" 660 watts, 250 volts, separable caps, catalog Nos. KE, MA to MD inclusive, MG, MJ.

Listed October 22, 1917.

Heating Appliances, Cooking and Liquid.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Ranges, 14 kilowatts or less, 110-220 volts, types 2-19B, 3-19B.

Hot plates, 1000-3000 watts, 100-250 volts, types 21, 22, 31.

Listed November 25, 1917.

Heating Appliances, Industrial and Laboratory.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

"Westinghouse," electrically heated appliances having heaters removable from stands or vessels with which they are intended for use.

Glue pots, 100-600 watts, 100-250 volts, style Nos. 138199-A to 138207-A inclusive, 146077-A to 146079-A inclusive.

Listed November 24, 1917.

Heating Appliances—Pressing Irons—General Electric Company, Schenectady, N. Y.

"G. E." Tailor's irons, 750-900 watts, 95-250 volts, type Z-1053, 12-24-pound sizes inclusive.

Listed October 10, 1917.

Miniature Motion-Picture Machine.—Automatic Motion Picture Machine Corporation, submittor, 220 West 42nd Street, New York City, N. Y., for General Machine Company, 417 East 156th Street, New York City.

Automatic self-rewinding motion-picture machine. The electrical parts of this device comprise an incandescent lamp and portable cord for attachment to supply circuit, a small motor and speed-regulating rheostat driving mechanism, automatic reversing switch and two cutoff switches.

Film sprockets designed for operation only with specially perforated films, 660 watts, 125 volts.

For use with slow-burning film only.

Listed September 5, 1917.

Motion-Picture Appliances—Arc Regulator.—Barlow Electrical Specialties Company, Inc., 73 Main Street, Yonkers, N. Y.

This device consists of a solenoid so designed that increase in voltage drop due to burning away of carbons causes a contact to be closed which completes circuit through a second solenoid, allowing a brake to be removed from clockworks which feed carbons. 0.15 ampere, 45, 55 and 70 volts.

Listed October 26, 1917.

Protectors.—Frank B. Cook Company, 326 West Madison Street, Chicago, Ill.

Consisting of carbon lightning arresters with inclosed cartridge fuses, mounted on porcelain bases; for use on signal circuits. Type B-7.

Listed November 30, 1917.

Protectors.—Reliable Electric Company, 411 South Sangamon Street, Chicago, Ill.

Consisting of carbon lightning arresters with inclosed cartridge fuses, mounted on porcelain bases, for use on signal circuits. With metal-inclosed arresters catalog No. 977.

Listed November 30, 1917.

Receptacles for Attachment Plugs, and Plugs.—Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins "Spartan," 10 amperes, 250 volts, catalog Nos. 29, 79, 104-110 inclusive, ME, MJ.

Listed October 22, 1917.

Receptacles for Attachment Plugs, and Plugs—Stage Type.—New York Calcium Light Company, 449-451 West 53rd Street, New York, N. Y.

"N. Y. C. L. Co." Fiber two-wire type receptacles and pin plugs for use only for portable stage appliances.

5 amperes, 125 volts, catalog Nos. 1001-02.

10 amperes, 125 volts, catalog Nos. 1014, 1016.

15 amperes, 125 volts, catalog Nos. 1501-02.

30 amperes, 125 volts, catalog No. 3002.

Listed September 12, 1917.

Receptacles, Medium-Base.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." porcelain shell, keyless, catalog No. 4003.

Listed October 17, 1917.

Resistance Appliances.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis., manufacturer for American Laundry Machinery Company, Cincinnati, Ohio.

"C-H" standard control equipment assembled in various combinations, A. C. and D. C., 220 volts or less, 10 horsepower or less. Designated by following equipment numbers: 98, 101, 102, 103, 107, 108, 111, 112, 113, 114, 115, 116, 117, 118, 123, 123A, 124, 124A, 155, 155A, 156, 156A, 156½, 157, 158, 161, 162, 163, 169, 170, 171, 172, 173, 173A, 173½, 174A, 175, 176, 177, 177A, 178A, 179, 179A, 179½, 180A, 180½, 183, 184.

Listed November 9, 1917.

Rosettes, Fuseless.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." 3 amperes, 250 volts, catalog No. 565.

Listed October 11, 1917.

3 amperes, 250 volts, catalog No. BE-S25.

Rosettes with pull-socket mechanisms, 3 amperes, 125 volts, 1 ampere, 250 volts, catalog No. BE-S24.

Listed November 7, 1917.

Socket Linings.—Elastoid Fibre Company, Waltham, Mass.

Linings for sockets and receptacles. "Elastoid" soft and hard styles.

The following lining is largely composed of asbestos fiber and a special binder and in process of manufacture is treated at a temperature of about 650 degrees Fahrenheit. "H. T. Elastoid."

Laboratories' tests show that this lining is reasonably uniform in thickness and diameter; is chemically neutral; has good dielectric strength; is absorptive of moisture to about the same degree as ordinary fiber linings; and is practically non-combustible. Its properties are but little changed by exposure to temperatures below 300 degrees Fahrenheit.

This lining is judged to be suitable for use in mogul sockets and receptacles, including those provided with shades, reflectors, fixtures or other inclosures above them and used with gas-filled incandescent lamps of above 100-watt capacity.

Listed November 6, 1917.

Socket Linings.—General Electric Company, Schenectady, N. Y.

"G. E." Linings for mogul-base sockets and receptacles for use in sockets and receptacles manufactured by the General Electric Company.

Listed November 6, 1917.

Sockets, Medium-Base.—Arrow Electric Company, Hartford, Conn.

"Arrow E." porcelain shell.

Key, catalog Nos. PA-913, PA-914, PA-948, PA-949, PA-951, PA-952, PA-953, PA-956, PA-958, PV-902 (4058-B), PV-904 (4065-B), PV-913, PV-914, PV-948, PV-949, PV-951, PV-952, PV-953, PV-956, PV-958.

Keyless, catalog Nos. PC-913, PC-914, PC-948, PC-949, PC-951, PC-952, PC-953, PC-956, PC-958, PW-901, PW-902, PW-903, PW-904, PW-913, PW-914, PW-917, PW-947, PW-948, PW-949, PW-951, PW-952, PW-953, PW-956, PW-958, 5053, 5065, 5082, 5084, 5105, 5133, 5134, 5135, 5136, 5138, 5142, 5143, 5146, 5147.

Pull, catalog Nos. PD-913, PD-914, PD-948, PD-949, PD-951, PD-952, PD-953, PD-956, PD-958, PX-901, PX-902, PX-903, PX-904, PX-913, PX-914, PX-917, PX-947, PX-949, PX-951, PX-952, PX-953, PX-956, PX-958.

Weatherproof, porcelain sockets.

Keyless, catalog Nos. 5054, 5063, 5106-07, 5137, 5140-41, 5144-45.

Keyless, 660 watts, 600 volts, catalog Nos. 5111-12, 5148-49.

Grip.—Also above types fitted with lamp.

Listed November 19, 1917.

Men in Service

Philadelphia Engineers' Service Flag—Woman's Committee Formed—Charles Piez Promoted to General Manager

THE ENGINEERS' CLUB OF PHILADELPHIA and affiliated societies, in its December Journal, devotes a page to its service flag. This flag, which has 140 blue stars, is shown in the colors—red, white and blue—and decorated with natural-colored holly wreaths. Beneath the flag, in blue letters, is the following message: "The Journal extends hearty Christmas greetings and best wishes for the New Year to all its readers, remembering particularly those members of the Club who, at their country's call, have enlisted in the national service."

SERGT. W. L. GEUDER, formerly connected with the Simplex Wire & Cable Company, Chicago, Ill., and previous to that with H. M. Byllesby & Company, is mess sergeant of Battery D, 332d Field Artillery and in this position recently won a prize for having the cleanest kitchen of any at Camp Grant, Rockford, Ill. Sergt. Geuder was the principal speaker at the meeting of the Electric Club-Jovian League at its meeting on December 13 and was instrumental in arranging for the serving of army mess on regulation mess kits, tables and benches, on that occasion.

An organization known as the Woman's Committee for Engineer Soldiers has been formed in Washington, D. C. Mrs. William M. Black, wife of General Black, chief of engineers, is president; Mrs. Charles Keller, vice-president and chairman; Mrs. W. W. Harts, secretary, and Mrs. Ulysses Grant, 3rd treasurer. The object of the Woman's Committee is to see that no engineer soldier leaves this country without the proper knitted garments and to send garments to those already "over there." The National Committee in Washington is to be headquarters for units all over the country and by purchasing yarn in large wholesale quantities should be able to get better prices and deliveries. The dues are one dollar a year, and a very earnest appeal is made to every man and woman interested in the engineers of the Regular Army, National Army, the Railroad, Forestry, Camouflage, or labor Regiments, to join this organization or to send contributions of money for wool, or finished knitted garments, to supply these hundred thousand men. Address Mrs. William M. Black, 1730 Eye Street, N. W., or Mrs. Ulysses Grant, 3rd, 2204 R. Street, N. W. Washington.

Nowadays, when a college casts about for a new president, it does not seek some one profoundly versed in Greek roots, or even famous for scientific research, but rather a man of known executive ability. It is in this light that Charles Piez, of the class of '89, School of Mines, has recently been appointed vice-president of the United States Emergency Fleet Corporation, and promoted to general manager of the Corporation on the resignation of Rear Admiral Frederick R. Harris last week,

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

and is charged with the special duty of expediting the construction of the vast number of ships so essential a factor in enabling us to throw our full strength into the war.

Mr. Piez is already well known as an executive who knows how to organize, and how to get things done. There has

Charles Piez.

been criticism of the appointment in the papers because he never built a ship, but he understands, like every successful executive, how to associate with himself technical knowledge where it is needed, and it is rare indeed that those possessing the highest specialized and technical knowledge are good executives.

Mr. Piez, who is about 51 years old, entered the School of Mines in the Class of '88. Before he had been in college more than a year, his father, who had been very successful, met with business reverses through the adoption of a new process in his business—a process now universally used but at that time not quite perfected. This would indicate that Charles Piez came honestly by his spirit of enterprise and initiative. He was obliged to leave college and for a year followed business pursuits, and then re-entered the School of Mines and graduated in the class of '89, teaching in night schools during two years of his course. What doubtless seemed a misfortune at the time was undoubtedly a real advantage, and his two years' experience in teaching probably had much to do with his remarkable facility for inspiring knowledge and enthusiasm in his associates. Although one of the best students in his class he was always interested in athletics, playing on his class football team and rowing with his class crew. He was also twice president of his class.

Almost immediately following his graduation he entered the employ of the Link-Belt Engineering Company, Philadelphia, as a draftsman and with the growth of the company held successively the positions of chief engineer, general manager and vice-president until 1906, when this company was merged with two affiliated companies in the west, forming the Link-Belt Company, of which Mr. Piez was elected president, the position he holds today. Under his able leadership the company has had an unbroken record of success and expansion. In particular its manufacturing and accounting methods, for the most part developed by Mr. Piez, have attracted wide attention and have been quite extensively adopted by other manufacturing concerns. Mr. Piez has a remarkable comprehension of underlying principles governing efficiency and intensified production, regardless of what the thing produced may be, and the wide circle of those who know him feel that the Shipping Board has been fortunate indeed to secure his services, which it need hardly be added he is giving in a spirit of pure patriotism and at a personal sacrifice.

In addition to personal and professional achievements, Mr. Piez has been very active in rendering public service. He was a member of the Commission that developed the Illinois Factory Act in 1909, and the following year acted as Chairman of the Illinois Workmen's Compensation Commission. He was an ardent sponsor of the plan of compensating workmen for industrial accidents and was largely responsible for bringing about the passage of the Act. Since the passage of the original Act he has served as Chairman of three voluntary commissions of employers and employees, who undertook the task of revising the Act in accordance with experience and a more enlightened public opinion.

Personal

Davis H. Tuck Joins Holophane Company—William A. Del Mar Becomes Engineer for Electric and Habirshaw Cable Companies—Charles T. Main Elected President of Mechanical Engineers

LESTER CAMPBELL has been appointed purchasing agent for the Illinois Northern Utilities Company, Dixon, Ill.

C. LOOMIS ALLEN, president of Allen & Peck, Inc., Syracuse, N. Y., has been appointed a director of the American Electric Railway War Board.

GEO. B. FOSS, formerly city electrician of Opelika, Ala., has been appointed superintendent of the City of Opelika Light and Water Department.

MICHAEL CONDON, Orange, N. J., has been appointed engineer at the municipal power plant by the City Commission, succeeding James McElroy, deceased.

E. E. JONES has been appointed superintendent of power plants with the Union Traction Company of Indiana. He will have charge of power plants at Anderson, Eaton, New Castle, Portland and Winchester. Prior to this appointment he was with the Peerless Rubber Manufacturing Company.

J. B. MYERS, who has been Tintic manager for the Utah Power & Light Company, of Salt Lake City, ever since the corporation took over the business and property of the Telluride and Knight companies in the Eureka district some years ago, has been given the management of the Bingham Canyon division.

W. S. RICHHART, who assumed the duties of electrical engineer for Fort Wayne & Northern Indiana Traction Company, at Fort Wayne, Ind., last September, previous to that date had spent a year with the Indiana Public Service Commission. Preceding this he was connected with the service department of Westinghouse Manufacturing & Supply Company, at its Philadelphia office. Prior to that Mr. Richhart served the University of Pennsylvania as instructor in electrical engineering.

DAVIS H. TUCK, until recently assistant physicist for the United States Public Health Service, has resigned to accept the position of commercial engineer for industrial and street lighting with the Holophane Glass Company, New York City. Mr. Tuck was graduated from the Massachusetts Institute of Technology in 1911, with a degree of B. S. of Electrical Engineering. For three years he was with the Photometric department of the U. S. Bureau of Standards at Washington, D. C., and since then has been illuminating engineer for the U. S. Public Health Service division of Field Investigation of Industrial Hygiene. While in this work he made a study of the status of illumination in the garment industry, New York City; the steel industry, Pittsburgh; public buildings, Washington; and has co-operated with the Industrial Commission of Wisconsin in inaugurating its campaign for better lighting in the state, being a member of the Wisconsin Committee for drafting a new code of lighting legislation for that state. Mr. Tuck will be in charge of the industrial lighting department of the Holophane Glass Company and will be in a position to give valuable assistance to anybody interested in the many intricate questions involved in the problem of proper industrial lighting.

L. G. VANNESS, vice-president of the Memphis (Tenn.) Gas & Electric Company has resigned, effective January 1. For several years Mr. VanNess was active head of the Merchants Power Company, of Memphis, and was largely responsible for the success of consolidation. He will remain in Memphis and engage in consulting work.

WILLIAM A. DEL MAR, late assistant electrical engineer to the Interborough Rapid Transit Company of New York, has resigned to become chief engineer to the Electric Cable Company, and the Habirshaw Electric Cable Company, Inc., at 10 East 43rd Street, New York City. Mr. Del Mar, who is a native of San Francisco, was graduated in 1900 from the City and Guilds' College of London. After completing a course in the testing department of the General Electric Company he became associated successively with the Manhattan Railway Company, the New York Central Railroad and the Interborough Rapid Transit Company. He made a specialty of transmission and distribution work while with the New York Central Railroad and was selected by the late H. G. Stott to design the distribution system of the new Interborough subways, and to re-design those of the old subways and elevated lines.

Mr. Del Mar is author of a book on wires and cables, entitled "Electric Power Conductors," and of the articles on wires and cables in Pender's Handbook. He was for several years chairman of the Wire and Cable Committee of the Association of Railway Electric Engineers, and in that capacity was active in the standardization of specifications for wires and cables. He is also secretary of the Joint Rubber Insulation Committee, which has prepared standard specifications and an analytical procedure for high grade rubber insulation. He has been a member of the Standards Committee of the American Institute of Electrical Engineers since 1913, and has taken an active part in its work, especially in matters relating to railroad standards and wires and cables. He is chairman of both the Subcommittee on Railway Standards, and the Subcommittee on Wires and Cables. In the latter capacity he is assisting the Navy Department in the design of cables for the new electrically-driven warships. Mr. Del Mar is also a member of the board of directors of the American Institute of Electrical Engineers. In his new position he will have charge of engineering work and will establish a research laboratory for investigating problems relating to wires, cables and insulating materials.

C. S. COLER has been promoted to director of trades training at the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The work consists in conducting the trades courses for machinists, pattern makers, tool makers, electricians and foundrymen.

CHARLES T. MAIN, who has been elected president of the American Society of Mechanical Engineers, is a prominent consulting engineer of Boston, Mass. Mr. Main was born in Marblehead, Mass., in 1856. He received his technical education at Massachusetts Institute of Technology, from which he was graduated in 1876. Three years later, after continuous service in the Institute as assistant in the department of mechanical engineering, he became a draftsman at the Manchester Mills, Manchester, N. H., leaving this concern in 1881 to enter the employ of the Lower Pacific Mills, Lawrence, Mass., where for eleven years he acted in the respective capacities of engineer, assistant superintendent and superintendent. Since 1892 he has practiced as a consulting engineer, with offices in Boston, until 1907 being associated with F. W. Dean in the firm of Dean & Main. Mr. Main has designed and supervised the construction of numerous industrial, steam-power and water-power plants, among his largest undertakings being the Wood Worsted and Ayer Mills in Lawrence, Mass., and four hydroelectric developments for the Montana Power Company, aggregating about 280,000 horsepower. Mr. Main became a member of the American Society of Mechanical Engineers in 1885 and has served on its board of managers for the past three years. He is also a member of the American Society of Civil Engineers and of several other engineering and technical societies.

Obituary.

A. G. TANNER, who started the first electric light plant at Mount Vernon, Ill., died in that city recently, at the age of 64 years.

THOMAS EUGENE BYRNE, vice-president, chief engineer, and founder of the Kings County Lighting Company, died December 14, at his residence, 51 Montgomery Place, Brooklyn, N. Y., aged 65 years.

WILLIAM MAHER, connected for 40 years with the Long Island Railroad Company, Long Island City, in the capacity of stationary engineer, died December 19, at the home of his sister, Mrs. Catherine Quackenbush, 48 Madison Avenue, Flushing, L. I.

Current News

Weekly Record of Construction Activities—Record of Electrical Patents Issued December 11

EASTERN STATES.

SKOWHEGAN, ME. — Central Main Power Company is planing a development of water power here that will cost $1,000,000. The company now owns all the water-power rights in the town, the Savage Manufacturing Company and Skowhegan Pulp Company's power, and recently bought the Bombazee Rips three miles above Norridgewock. The main dam at Skowhegan Falls is to be raised seven feet. A part of this dam is of concrete and this only will be raised while the other half will be entirely rebuilt. The remainder of the plan is yet undecided. Skowhegan is much in need of this additional power as only 6000 horsepower is developed there, of which 4000 horsepower is available. The new development will be to 25,000 horsepower, of which 20,000 horsepower will be available.

PROVIDENCE, R. I.—Providence Gas Company is making rapid progress in the construction of additions to its plant at Sassafras Point, Providence, to consist of two one-story structures, and two two-story buildings. The entire work is estimated to cost $40,000. The Charles B. Maguire Company, Turks Head Building, Providence, is the contractor.

HARTFORD, CONN.—J. Henry Roraback as attorney for the Rocky River Company, which is developing the water power of the Naugatuck Valley at an estimated expense of $4,000,000 or $5,000,000 and Engineer Chrisford, of Philadelphia, have conferred with Highway Commissioner Charles J. Bennett on the project to construct a state highway about six miles long, to take the place of the road that is to be eliminated in connection with the work of building the company's dam near Stevenson. It has been estimated that if the water power which is proposed to be developed, were available this year, a million dollars worth of coal could have been saved in Connecticut. New Britain and Waterbury are the principal manufacturing centers that will be supplied with power by the company.

NEW HAVEN, CONN.—Project is under contemplation for constructing three reservoirs near Torrington at cost of $1,300,000. C. H. Preston, Jr., engineer, Waterbury, Conn.

WATERBURY, CONN.—International Silver Company, Meriden, Conn., has awarded a contract to Lewis A. Miller, 21 Church street, Meriden, for the construction of a new one-story and basement power house, about 45x80 feet, at its local plant on Silver street.

BINGHAMTON, N. Y. — Binghamton Light, Heat & Power Company has secured a contract from the Binghamton Cold Storage Company for supplying power to the amount of 100 horsepower. Rapid progress is being made in the construction of the new power house of the company, and work will be commenced at an early date for the installation of two 600 horsepower boilers, together with the stokers and forced draft fan. Work has been completed on the installation of the boiler feed pump, which has a capacity for the operation of five boilers.

BROOKLYN, N. Y.—Transit Development Company, a subsidiary of the Brooklyn Rapid Transit Company, has filed plans for a $500,000 addition to its generating power station at Kent and Division avenue.

BUFFALO, N. Y.—Kittinger Furniture Company, 15 Front avenue, has had plans prepared for the construction of a power house addition to its plant at 1893 Elmwood avenue.

BROOKLYN, N. Y.—The Eastern Flexible Conduit Company, 141 Gardiner avenue, has filed notice of an increase in its capitalization from $50,000 to $150,000 to provide for expansion.

BROOKLYN, N. Y.—The United States Government, Bureau of Yards & Docks, has had plans prepared for the installation of a new electric lighting system in the local navy yards, to cost about $8,000. F. R. Harris, chief.

JAMESTOWN, N. Y.—Luminous Sign Company has incorporated with a capital of $100,000, for the purpose of manufacturing signs, displays, etc.

MONTOUR FALLS, N. Y. — Shepard Electric Crane & Hoist Company has increased its capital from $500,000 to $1,000,000 for extensions.

NEW YORK, N. Y.—Washburn Wire Company, 117th street, is having plans prepared for the reconstruction of its plant which was recently destroyed by fire. The new works are estimated to cost $350,000.

NEW YORK, N. Y.—New York Telephone Company, 15 Dey street, has awarded a contract to W. A. L'Hommedieu & Company, 1 Madison avenue, for alterations and improvements in its plant at 117 West Thirty-eighth street. The company has also acquired property on One Hundred and Forty-sixth street, near Amsterdam avenue, for a consideration of $42,125, and is said to be planning to use this for extensions.

NEW YORK, N. Y.—H. B. Shontz Company has incorporated with a capital of $50,000 to make motors, engines and electric batteries. The incorporators are J. A. Smith, H. B. Shontz and P. J. Durham, 244 West 49th street, New York City.

NEW YORK, N. Y.—Shapiro & Aronson have incorporated with a capital of $250,000. They manufacture electrical fixtures and the incorporators are I. Kaplan, D. Shapiro and I. Pecker.

NEW YORK, N. Y.—Pyrinol Flashlight Corporation. Capital, $25,000. Incorporators: F. Demaric, S. Goodman and N. P. Lefkaditis, 140 Liberty street, New York City.

NEW YORK, N. Y.—Bos General Corporation of America. Capital, $100,000. To manufacture electrical fixtures. The incorporators are W. A. Noble, and R. Bos, 90 West street, New York.

ROCHESTER, N. Y.—Rochester Railway & Light Company has made application to the Public Service Commission for permission to issue preferred stock to the amount of $4,000,000, of which $465,000 is to be used for capitalization purposes, the remainder to provide for outstanding accounts, improvements, etc.

WATERTOWN, N. Y.—Plans have been completed for construction of a power plant to cost about $300,000. The architects and engineers are S. M. Greene & Company, Springfield, Mass.

CAMDEN, N. J.—Philadelphia Electric Company, Philadelphia, Pa., a New Jersey corporation with offices at 417-19 Market street, has filed notice of the dissolution of the company. It is said that the concern will operate in Pennsylvania exclusively.

GLOUCESTER CITY, N. J.—Welsbach Lighting Company has tendered an offer to the City Council to install an electric street-lighting system as an exhibit in the municipality.

HIGHTSTOWN, N. J.—Borough Council is planning for extensive improvements at the local waterworks, including the installation of new power equipment.

HOPEWELL, N. J.—Borough Council has awarded a contract to the Public Service Corporation for supplying service for its electric street-lighting system for a period of one year.

JERSEY CITY, N. J.—City Commission is planning for improvements in its police and fire alarm system, including the installation of an underground conduit system to replace the present overhead wires.

JERSEY CITY, N. J.—Standard Electric Manufacturing Company. Capital, $200,000. To manufacture electrical appliances of all kinds. Incorporators: Jules E. Brand, H. A. Black, and Walter J. Hilton, Jersey City.

NEWARK, N. J.—Public Service Corporation is planning for the extension of its trolley system from Newark to Port Newark via. Avenue R, to facilitate the transportation of employees of the large shipbuilding plants at the latter point.

OCEAN GROVE, N. J.—Due to the shortage of coal, town officials have decided to supply electric current during the hours of 9 a. m. and 3 p. m. of each day.

PRINCETON, N. J.—Work has been completed on the installation of an underground conduit system in Stockton street by the Public Service Corporation. The Borough Council is planning for improvements in its electrical street-lighting system, providing for underground wires to replace the present overhead lines.

ALTOONA, PA.—Penn-Central Light & Power Company has filed notice with the Public Service Commission of a bond issue for $15,000 to provide for improvements, etc.

BENTLEYVILLE, PA.—The borough council is considering the installation of a new street lighting system, the cost not to exceed $1,000. The plans call for six 250-candlepower incandescent lamps on the main thoroughfare and a large number of 80-candlepower lamps on the avenues and alleys.

CRANBERRY CREEK, PA. — Cranberry Creek Coal Company is making rapid progress in the electrification of its plant, and is planning to inaugurate operations at an early date.

FALMOUTH, PA.—York Haven Water & Power Company is making rapid progress in the construction of a dam across the Susquehanna River, at a cost of about $30,000. This will enable the company's plant to greatly increase its electric production.

HAZLETON, PA.—Harwood Electric Company has completed the installation of a new 15,000 horsepower turbo-generator, and is planning to increase the capacity of its plant to 45,000 horsepower. It is planned to connect the lines at the Harwood station with the plant of the Lehigh Navigation Electric Company at Hauto, making them two links in a chain of high tension power plants running through the eastern section of Pennsylvania.

LANCASTER, PA.—Conestoga Traction Company has filed notice with the Public Service Commission of the issuance of car trust certificates for $50,000, to provide for extensions.

LEBANON, PA. — Cornwall Railroad Company, operating between this city and Mount Hope, Lancaster County, has equipped all of its locomotives with new high-power electric headlights. The new light permits of objects being clearly distinguishable at a distance of 1500 feet.

NEW CASTLE, PA.—Mahoning & Shenango Railway & Light Company has filed notice with the Public Service Commission of a bond issue for $250,000 to provide for improvements, extensions, etc.

PHILADELPHIA, PA. — Philadelphia Electric Company has made application to the Public Service Commission for permission to increase its lighting rates in accordance with the increases in the cost of fuel, effective January 1.

PHILADELPHIA, PA.—Common Council has passed an ordinance for extensive improvements in its electric street-lighting system, to include the relocation of certain of its lighting units and the installation of additional lamps. Thomas B. Smith, mayor.

PHILADELPHIA, Pa.—Unit Construction Company, 131 South Thirty-first street, is making rapid progress in the construction of a new power house addition to its plant at Fifty-seventh street

and Grays Ferry avenue. The structure, in connection with another shop building now in course of erection, is estimated to cost $75,000. J. N. Gill & Company, 112 South Sivteenth street, Philadelphia, are the contractors.

PHILADELPHIA, PA.—Bell Telephone Company, Seventeenth and Arch streets, has had plans prepared for alterations and improvements in its administration building at Eleventh and Filbert streets.

PHILADELPHIA, PA. — Pennsylvania Railroad Company has issued orders providing for the extinguishment of lights on the passenger bridge when trains are not being loaded, for the purpose of conserving electricity.

PHILADELPHIA, PA.—Philadelphia & Reading Railroad Company has had plans prepared for the erection of a power house and signal tower at its Skillman, N. J., yards.

READING, PA.—Metropolitan Edison Company is rushing to completion the construction of a new pump and heater house at its West Reading power plant. The pumps to be installed in the addition will have a capacity of 1200 gallons per minute, feeding the water from Wyomissing Creek to the 20,000 horsepower heaters. The company has also completed the installation of a new 1500 K. W. rotary at its South Seventh street distributing station.

READING, PA. — Tri-County Electric Company, Lancaster, has secured a contract from the Wilmington & Northern Railroad for supplying power for the operation of the pumps at the large new water station now in course of construction for the Reading-Wilmington line.

READING, PA.—Metropolitan Edison Company has filed notice with the Public Service Commission of a preferred stock issue for $316,300 to provide for extensions, improvements, etc.

WILMINGTON, DEL.—Mountain States Power Company. Capital, $15,000,000. To manufacture and generate current for light, heat, power, etc. Incorporators: M. M. Clancy, C. L. Rimlinger, Wilmington; and C. M. Egner, Elkton, Md.

BALTIMORE, MD.—Consolidated Gas, Electric Light & Power Company, Lexington street, has had plans prepared for the construction of a new electric light distributing station at Custom House avenue and Water street, to cost about $10,000.

HERNDON, VA.—Herndon Light & Power Company has incorporated with a capital stock of $15,000, to establish a light and power plant. C. N. Florence is president and E. E. Gillette, secretary.

CHARLESTON, W. VA.—Bureau of Yards & Docks, Navy Department, Washington, D. C., has awarded a contract to the G. E. Engineering Company, 417 Canal street, New York, for the construction of an electric duct system at the local naval propectile plant, at $8,988.

ST. MARYS, W. VA.—St. Marys Light & Power Company will build an electric light plant according to plans bought by R. H. Adair, 501 Juliana street, Parkersburg.

FREMONT, N. C.—City had plans prepared for the construction of a local substation, new transmission line, 22,000 volt, about 10 miles long, and arc-light and distributing systems, and will receive bids until January 3. B. O. Austin, Raleigh, consulting engineer.

PARKTON, N. C.—City council is considering an issue of $5000 in bonds for the installation of an electric lighting system. F. N. Fisher is mayor.

CHARLESTON, S. C.—United States Government, Bureau of Yards & Docks, has awarded a contract for improvements in its local power plant to cost $119,875. Gillis & Geoghegan, 537 West Broadway, New York, are the contractors.

ATLANTA, GA.—City council adopted plan to erect a $75,000 electrical generating plant at the city crematory. The Georgia Railway & Power Company has agreed to buy all electrical current generated at the new plant, paying for it at the same rate which the city now pays to the corporation for electric power and lighting current. It is estimated that after the plant has been paid for out of the profits, the revenue to the municipality will be in the neighborhood of $50,000 annually.

BONIFAY, FLA.—Until January 3, Town Council will receive bids for the erection of a new electric lighting plant. The J. B. McCrary Company, Atlanta, Ga., is engineer.

OKEECHOBEE, FLA. — Okeechobee Telephone Company. Capital, $15,000. To operate a telephone exchange plant. Incorporators: R. E. McLaughlin and B. M. McLaughlin, Okeechobee.

DATES AHEAD.

American Institute of Consulting Engineers, Inc. Annual meeting, January 14. Secretary, F. A. Molitor, 35 Nassau Street, New York City.

Electrical Contractors' Association of State of Missouri. Annual convention, January 19. Secretary, A. J. Burns, 318 West Tenth Street, Kansas City, Mo.

Minnesota Electrical Contractors' Association. Annual convention, Minneapolis, Minn., January 20. Secretary, G. M. Jones, 112 South Seventh Street, Minneapolis.

Northern White Cedar Association. Twenty-second annual meeting, Hotel Radisson, Minneapolis, Minn., January 22-23, 1918. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Memphis, Tenn., January 29-30-31. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, February, 1918. Secretary-Treasurer, L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill.

Vermont Electrical Association. Annual meeting, February, 1918. Secretary-Treasurer, C. H. West, Rutland, Vt.

National Association of Electrical Inspectors. Annual convention, New York, March, 1918. Secretary-Treasurer, William L. Smith, Concord, Mass.

Wisconsin Electrical Association. Annual meeting, March, 1918. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Southwestern Society of Engineers. Annual meeting, April, 1918. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Kentucky Association of Electrical Contractors. Annual meeting, May, 1918, Louisville, Ky. Secretary, F. F. Valinoti.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Georgia Electrical Contractors' Association. Annual meeting, June, 1918, Tybee Island, Ga. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

NORTH CENTRAL STATES.

CHARDON, OHIO.—There will be a special election January 2 to determine on a bond issue of $25,000 for improving the municipal electric lighting plant and equipping the same for Chardon.

CLEVELAND, OHIO.—Canada Gas & Electric Corporations, with headquarters here, has incorporated under the laws of Delaware, with an authorized capital of $2,500,000. The company has a branch at Brandon, Manitoba, and will open many branches throughout Canada in the principal cities. The company is contemplating erecting many plants and direct dealings will be transacted through the headquarters at Cleveland. Electric equipment, wire, dynamos, transmitters, etc., will be required. Address Cyrus S. Eaton, president, Cuyahoga Building, Cleveland, Ohio.

STEUBENVILLE, OHIO. — Windsor Electric Company has incorporated with a capital of $10,000. H. M. Daugherty, R. L. Buffington, F. T. Wagenhals, E. S. Browne and R. F. Rarey are the incorporators.

TOLEDO, OHIO.—Breco Electric Company has incorporated with a capital stock of $50,000. The incorporators are M. G. Lang and H. A. Stafford, of the E. Pauck Machine Company. Z. M. Delaney is president of the new firm; E. L. Schamburg, vice-president, and H. A. Stafford, secretary. The company's office is located at 206 Huron street and it will manufacture electric machines used to charge storage batteries. The officers state that they hold valuable patents on several electrical appliances for automobile equipment. These will be manufactured later by the company. A new plant will not be built for the present.

FORT WAYNE, IND.—The municipal steam-electric plant here which now has a generating capacity of 5500 kilowatts, will be increased to 8500 kilowatts by the installation early in 1918 of new equipment purchased early in 1917. This consists of a General Electric turbo-generator, which cost $43,000; a Westinghouse condenser, costing $22,500; a Bass water-tube boiler, at a cost of $26,000; a Detroit stoker, which cost $4000. A contract was let in December for the construction of 75 by 75-foot addition to the boiler house, to cost $32,000, the building to be completed by next May. At the same time another contract was let for the building of a brick stack at a cost of $8400.

FORT WAYNE, IND.—Hoffman-Harber Company has incorporated to deal in electrical apparatus. The incorporators are Henry Hoffman, Fred Harber and Howard Beneninghoff.

EDWARDSVILLE, ILL. — Madison County Light & Power Company, a subsidiary of the Illinois Traction System, has been granted permission by the Illinois Public Utilities Commission to increase its capital stock from $335,000 to $500,000.

HILLSBORO, ILL.—Southern Illinois Light & Power Company has applied to the Illinois Public Utilities Commission for permission to construct a power line from Du Quoin to Pinckneyville, Ill., and to furnish light and power to adjacent territory. The company also seeks to increase its rates at Morrisonville, Ill.

MARQUETTE, MICH.—Charles Retallic, superintendent of the department of light and power, is of the opinion that the present water shortage in Dead River, which will be the means of curtailing electrical service in Marquette considerably during the next few months, points the necessity of the city commission making plans for early installation of the proposed new power plant. The new plant would have a capacity of 3200 horsepower, whereas the plant now here has 2400 horsepower. The estimated cost of the new plant is $75,000.

ANTIGO, WIS.—Electric Farm Lighting & Power Company has incorporated with a capital of $25,000. The incorporators are John T. Brown, Robert P. Brown and John H. Walecha.

OOSTBURG, WIS.—Oostburg Lumber & Grain Company is having the Milwaukee Northern Company's crew at work equipping its plant for electric power to replace steam power.

HUTCHINSON, MINN. — Northwest Light & Power Company recently suffered a loss amounting to $3000, when transformers at Young America burned out. The two reserve power steam engines in the plant here kept the current on. At a cost of $1500 the company has installed a voltage equalizer which will make the service much more satisfactory and give steady power and unflickering lights.

LOUISBURG, MINN.—Bond issue of $2500 for municipal electric light plant carried at election.

SEBEKA, MINN.—Council is planning to secure electricity from the Little Falls Water Power Company at Little Falls.

ST. PAUL, MINN.—With the understanding that no work would be attempted until after the war the St. Paul city council requested the department of public works recently to investigate and report on the feasibility of establishing a municipal lighting, heating and power plant. Address City Engineer Claussen.

CLERMONT, IOWA.—A white way has been installed on Main street.

LEMARS, IOWA.—Iowa Light, Heat & Power Company's new power plant will be in operation January 1. The building is completed and the dynamos, engines and boilers installed and the machinery is now being connected up. The transmission line to Remsen is ready for wires. Alton, Kingsley, Orange City and Remsen will get electric current from this station as soon as it begins operations and several other towns will be added next spring.

MORNING SUN, IOWA.—Burlington Railway & Light Company, of Burlington, has applied to council for franchise to furnish electricity to Morning Sun. The company contemplates building transmission line from Burlington, Mediapolis, Morning Sun, Wapello and Winfield. Address J. W. Kale, manager.

KANSAS CITY, MO.—Kansas City Light & Power Company has com-

menced the construction of the first unit of its one-story power house, about 175x250 feet, at Scott avenue and Missouri River. The entire plant, when completed, is estimated to cost $1,000,000. The Foundation Company, Rookery Building, Chicago, Ill., is the contractor.

OZARK, MO.—Finley Light Company has incorporated with a capital of $10,000. The incorporators are George T. Breazeale, D. W. Bingham and others.

ST. JOSEPH, MO.—City contemplates improvements to electric light plant, costing $31,000, to provide power for ornamental lighting system.

LARNED, KANS.—The transmission wires of the municipal plant of Larned are to be extended from the state hospital for the insane, three miles west of Larned, to the town of Gillespie, a total distance of 11 miles. Larned will make a rate of three and one-half cents per kilowatt hours for the first year. There will be a number of large consumers at Gillespie, the ranch houses and farm houses around Gillespie being also anxious to secure electric current for light and power.

PITTSBURG, KANS. — Home Light, Heat & Power Company has asked permission of the public utilities commission to issue $12,000 worth of gold debenture bonds, bearing 6 per cent interest. This money is to be used for improvements and betterments already made in the plant here.

FITTSBURG, KANS.—Ray Ryan Electric Company has incorporated with a capital of $20,000.

HARROLD, S. D.—Harrold Light & Power Company has incorporated with a capital of $12,000. The incorporators are P. J. Suhn, Harry Weeney and David Miller.

BELFIELD, N. D.—City may buy the plant of the Chrystler Light & Power Company here, and an appraisal of the plant has been made by Prof. J. F. Stevens of the state university.

SOUTH CENTRAL STATES.

LEXINGTON, KY.—Kentucky Utilities Company has begun serving LaGrange, Ky.

LOUISVILLE, KY.—A tentative increase of $7,000,000 in the assessment of the franchise of the Louisville Gas & Electric Company has been made by the city assessor of Louisville. The previous assessment was $6,000,000. Under the provisions of the tax law it devolves on the company to show cause why the assessment should not be increased.

MAYSVILLE, KY.—Cochran Brothers Corporation is changing its name to the Maysville Power Company.

OWENSBORO, KY.—Owensboro Home Telephone & Telegraph Company has increased its capital from $10,000 to $100,000. Improvements will be made.

KNOXVILLE, TENN.—Knoxville will be the best lighted city in the South according to M. T. Link, of the Knoxville Railway & Light Company when the installation of the new street lights is completed by Feb. 1. Altogether 287 type "C" lamps ordered for the suburban sections have been installed and the remainder are being placed.

MEMPHIS, TENN.—Memphis Gas & Electric Company has purchased 1100 acres of coal bearing land in Christian County, Ky., at Mannington, with two mines already developed, and will operate these mines to obtain its required supply of coal. It is presumed that a subsidiary corporation will be organized as the operating company.

MONTGOMERY, ALA.—Montgomery Light & Water Power Company will construct electric transmission system from plant in North Montgomery to aviation field.

MONTGOMERY, ALA. — Two franchises, authorizing the construction of a railroad line from Fatt City through Wylam and Ensley to the City of the new Fairfield plate mill which the Tennessee Coal, Iron & Railroad Company is erecting there, were granted to the Birmingham Southern Railway and the Tennessee company by Montgomery commissioners. The cost of the road will approximate $100,000 and will furnish transportation facilities to the new ship plate plant of the Tennessee company and furnish an outlet through the Birmingham Southern to the main railroad trunk lines.

HALEYVILLE, ALA.—Alabama Power Company engineers are here now, surveying power line to be built from Warrior River to the nitrate plant at Sheffield.

SHEFFIELD, ALA.—Alabama Power Company is said to be planning for extensive improvements and additions to its Warrior River electric plant to provide power for the operation of the new cyanimid plant now in course of construction for the Government. The work is estimated to cost about $3,000,000.

FORT SMITH, ARK.—An agreement has been reached between the city commissioners and the Fort Smith Light & Traction Company for a ten-year contract to light the city's streets. The contract the city had with the company expired December 7.

DURANT, OKLA.—Consumers Light & Power Company is planning for the immediate reconstruction of its electric plant recently destroyed by fire.

WOODWARD, OKLA.—City is planning for a bond issue for $20,000 for the construction of a municipal electric-lighting plant.

AMARILLO, TEX.—City commission has under consideration plans for the construction of a municipal electric light plant here. The proposition of voting $200,000 bonds for the purpose will probably be submitted to the taxpayers soon.

DALLAS, TEX.—Dallas Electric Company has asked permission to issue $2,150,000 common stock; $500,000 at 7 per cent preferred and $2,600,000 of unsecured notes due April, 1922. The proceeds of the issue of securities are to pay for additions to be made in the next two or three years.

MARFA, TEX.—Marfa Electric & Ice Company will install additional machinery in its electric light and power plant here. The company has also been granted a franchise to supply the city with water for domestic purposes. It will sink a number of wells and install pumps as a means of providing the water supply.

WACO, TEX.—Mackay Telegraph Cable Company will install a system for long distance telephone service. Address J. Hargrove, superintendent, Dallas, Tex.

WESTERN STATES.

BUTTE, MONT. — Havre Electric, Steam, Heat & Telephone Company, with principal offices here has dissolved. The petition of dissolution states that there are no debts or obligations.

HARLOWTON, MONT.—Montana Power Company is installing a lighting system for this place at a cost of approximately $4000.

HOT SPRINGS, MONT.—Conrad Smith and F. E. Campbell are making arrangements to install a lighting and power plant.

MISSOULA, MONT.—Northern Pacific Railway Company will install a railway telephone system for communication between headquarters of the Rocky Mountain Division in this city and Livingston, also Coast points and Spokane as well.

DENVER, COLO.—The system of lighting used at the San Diego exposition will be installed in the civic center it was decided at a conference of the Park Board with Mayor Speer. An arrangement whereby beautiful illuminating effects may be obtained by the reflection of lights through the trees will be made use of.

BOISE, IDA.—Council has passed an ordinance confirming the creation of local light improvement district Number 2 and providing for installation of a system of ornamental 250-candlepower nitro-filled Mazda lights on certain streets.

COLFAX, WASH.—Pacific Telephone & Telegraph Company has submitted a new franchise to the city council, requesting that same run for 20 years.

SEATTLE, WASH.—Boeing Airplane Company has increased its capital stock from $100,000 to $500,000. The company has become very active in prosecuting its work of construction.

SEATTLE, WASH.—Daniel Huntington, city architect is preparing plans for construction of a new sub-station for the city lighting department at West 49th street and Fourteenth avenue Northwest, to cost about $75,000. The building will be one and two stories, 66x66 feet of reinforced concrete and cost about $20,000. The remainder of the sum will be used to purchase generator and other equipment. Bids will be called for in about three weeks.

SEATTLE, WASH.—Ordinance has been introduced in the city council here, directing the board of public works to buy the line and equipment of the Loyal Railway Company, to be operated as a part of the municipal street car system. Harry Whitney Treat, owner of the Loyal Heights line has agreed to sell same to the city for $40,000, which is $30,000 less than a previous offer. In accordance with the agreement reached with Mr. Treat, ordinance provides that payment be made in city railway extension bonds. Securing of this line will extend Division A, after construction already authorized is completed, to the northerly city limits at Thirty-second avenue northwest and west to Eighty-fifth street.

SPOKANE, WASH.—Missoula Light & Water Company has filed notice of increase of its capital stock from $1,000,000 to $1,500,000. Improvements and extensions will be made.

SPOKANE, WASH.—Washington Water Power Company has completed its plans for extending its line into Coeur d'Alene. The company plans to issue $2,800,000 of 6 per cent notes, payable Jan. 2, 1919, which will be sold for 99 to net the purchaser 7 per cent. The issue will give the company $640,000 for extensions and improvements, the balance of the money received going to refund outstanding notes, amounting to $2,160,000, due Feb. 2, 1918. Spokane and New York banks are now offering the notes for sale.

Electrical Patents Issued December 11, 1917

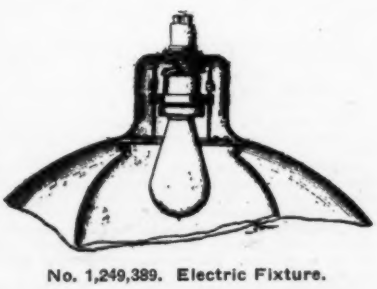
1,249,313. Switch Box. J. C. Boyton and O. H. Nickerson, Cleveland, O. Tongue and groove arrangement for connecting side plates to end walls.

1,249,316. Spark Plug. G. L. Brewer, Kent City, Mich. Includes tubular sight chamber.

1,249,359. Section Insulator. G. B. Ely, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. For trolley wires.

1,249,364. Inverted-Lamp Shade-Holder. T. D. Finizio, assignor of two-thirds to H. C. Biglin and L. E. Moffatt, New York, N. Y. Spring fingers engage bulb so as to hold shade below lamp tip.

1,249,374. Phonograph-Illuminating Appliance. M. H. Gaba, Philadelphia, Pa.



No. 1,249,389. Electric Fixture.

Switch automatically closes record-illuminating circuit while needle is being adjusted.

1,249,386. Telephone-Switch Mechanism for Preventing Cord-Twist. H. Hansen, Kansas City, Mo. Associated with cord for receiver.

1,249,389. Electric Fixture. G. A. Harter, Chicago, Ill. Socket and shade-holder are each adjustably supported by the yoke. (See cut.)

1,249,396. Attachment for Automobiles. F. L. Heyer, Chicago, Ill. Locking switch for ignition circuit.

1,249,400. Mining Machine. E. L. Hopkins, assignor to Jeffrey Mfg. Co., Columbus, O. Electric coal-cutting machine.

1,249,409. Sound-Transmitting Appa-

ratus. A. D. Jones, Philadelphia, Pa., assignor of 40 per cent to F. Lyster. A number of electric microphones associated with phonograph.

1,249,414. Process of Making Talking-Machine Records. J. Kaiser, New York, N. Y. Protecting film on metal record disk is cut in recording and exposed metal is electrolytically decomposed.

1,249,443. Color-Identification Device. N. Macbeth, New York, N. Y. Includes a "daylight" tungsten lamp and ordinary incandescent lamps and a switch for interchanging the light sources.

1,249,464. Laundry Appliance. H. M. Nolen, Toledo, O. Flatiron with thumb switch in handle.

1,249,465. Spark Plug. G. V. Nolte and J. E. Smith, Bellingham, Wash. Electrode is in perforated cage engaging valve seat.

1,249,479. Electric Furnace for Producing Endothermic Gas Reactions. R. Pfaehler and I. Hechenbleikner, assignors to Southern Electro-Chemical Co., Charlotte, N. C. Has means for circulating air to cool each electrode.

1,249,481. Binding Post. H. E. Phillips, assignor to Dayton Engineering Laboratories Co., Dayton, O. Has spring sliding clamping contacts.

1,249,482. Radiotelegraphy and Telephony. G. W. Pickard, assignor to Wireless Specialty Apparatus Co., Boston, Mass. Receiving system wherein permanently adjusted secondary may act at any wavelength.

1,249,487. Weighing Scale. E. C. Pool, assignor to Toledo Scale Co., Jersey City, N. J. Electromagnetic means for moving the poise.

1,249,500. Interior Illumination. E. A. Richter, assignor to The Mathiew Corp., Pittsburgh, Pa. Sectionalized removable troughs for furnishing cove lighting.

1,249,526. Electric Switch. W. G. Shelton, New York, N. Y. Centrifugal switch for motor.

1,249,530. Electromagnetic Ship's Log. C. G. Smith, Cambridge, and J. Slepian, Boston, Mass. Magnetic field is projected in the water transverse to movement of ship and electromotive force induced is measured.

1,249,532. Electric Welding. H. M. Smith and W. W. Stanley, assignors to W. H. Walker, New York, N. Y. Overlapping edges of sheets are brought together at angle and welding current passed through.

1,249,537. Safety Stop for Elevator Motors. A. Sorlien, Austin, Minn. When discharge chute of bucket elevator is filled or clogged motor switch is opened.

1,249,567. Shade-Holder for Lamps. A. Walsh and W. Hancock, Toronto, Ont., Canada. Includes split expansion ring with finger grips.

1,249,570. Signaling System. S. S. A. Watkins, assignor to Western Electric Co., New York, N. Y. Special generator for selective telephone ringing.

1,249,573. Spark Plug. F. E. Welker, Beaver Creek, Minn. Electrodes extend into recess in porcelain.

1,249,574. Electric Lamp. G. E. Werner, Los Angeles, Cal. Flashlight for standard-size dry cell.

1,249,582 and 1,249,583. Telephone-Exchange System. J. L. Wright, assignor to J. R. Garfield, Cleveland, O. Semi-automatic system.

1,249,597. Electric Oxidizer. D. M. Clark, Phoenix, Ariz. Has axial electrode in metallic tube.

1,249,620. Dough Raiser. C. F. Hardy, Harvard, Nebr. Heating element at lower side of cover of cabinet.

1,249,638. Electric Flatiron. A. R. King, assignor to F. R. King, New York, N. Y. Pressing on handle actuates cutout switch.

1,249,652. Electric Lamp. J. Mersing, Zollikon (near Zurich), Switzerland. Reflector housing for incandescent lamps.

1,249,654. Electromagnetic Blower. E. K. Muller, Kilchberg, Switzerland. Varying magnetic field actuates piston to produce pulsating air currents.

1,249,655. Apparatus for Truing Up Commutators for Electric Machines. A. Norrel, Baden, Switzerland. Grinding block is traversed across face of commutator.

1,249,673. Circuit-Controlling Device. H. O. Rugh, assignor to Railway Electric Mfg. Co., Chicago, Ill. Signal relay.

1,249,682. Controlling System for Electric Elevators. W. S. Smith, Cambridge, Mass. Safety lockout for push-button-controlled automatic elevator.

1,249,685 and 1,249,686. Automatic Train-Stop. E. C. Stafford, assignor to Railway Automatic Safety Appliance Co., Philadelphia, Pa. Electrically controlled valve.

1,249,694. Casing for Electric Apparatus. O. C. Voss, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Case for transformers, etc., with external annular chamber for cooling the oil.

1,249,699. Photographic-Printing Apparatus. J. G. Warren, Cheney, Wash. Includes electric switch.

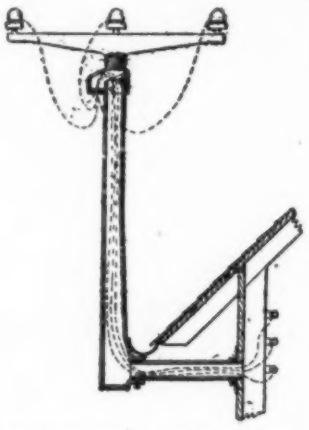
1,249,711. Electric Connector. J. Berg, assignor to Metal Specialties Mfg. Co., Chicago, Ill. Spring plug terminal.

1,249,717. Combined Fire-Alarm and Annunciator. J. Carrigan, Seattle, Wash. Includes illuminated floor plan to show location of stations.

1,249,732. Magneto. L. J. Flint, assignor to Grip Nut Co., Chicago, Ill. Includes circuit-breaker.

1,249,746. Control Apparatus. A. J. Hall, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Release of controller handle raises it and throws controller to "off" position.

1,249,747. Control System for Electric Motors. A. J. Hall, assignors to Westinghouse Electric & Mfg. Co. Semi-automatic control for traction car.



No. 1,249,866. Lead-In Fixture.

1,249,748. Control Apparatus. A. J. Hall, assignor to Westinghouse Electric & Mfg. Co. Arc-disrupting spray is blown on contacts of drum controller.

1,249,761. Device Regulating the Speed of Trains. A. F. Jacobson, New York, N. Y. Track-controlled solenoids control different positions of locomotive throttle valve.

1,249,770. Method of Coating Electric Condensers. W. H. Kempton, assignor to Westinghouse Electric Mfg. Co. Coating material is hardened by successive application of heat and pressure.

1,249,773. Telegraphy. C. Kinsley, Chicago, Ill. High-speed printing telegraph receiver.

1,249,782. Balanced Phase-Converter System. R. R. Lawrence, assignor to Westinghouse Electric & Mfg. Co. For supplying three-phase load from single-phase source.

1,249,783. Rotary Phase-Converter System. R. R. Lawrence, assignor to Westinghouse Electric & Mfg. Co. Modification of above.

1,249,787. Apparatus for Electodeposition of Metals. A. Leuchter, Brooklyn, N. Y. Provides circulation of electrolyte by means of air currents.

1,249,800. Transformer. J. E. Mateer, assignor to Westinghouse Electric & Mfg. Co. Insulating laminae are interposed between leakage paths between coils, core and casing.

1,249,820. Insulator. H. A. Fharo and W. Schaake, assignors to Westinghouse Electric & Mfg. Co. Pin type; adjustable outer flange carries conductor-supporting finger.

1,249,823. Mining Machine. C. A. Pratt, assignor to Goodman Mfg. Co., Chicago, Ill. Motor-driven coal cutter.

1,249,830. Spark Plug. H. E. Rider, assignor to P. T. Lehr and J. H. Murphy, New York, N. Y. Weight at lower end of electrode stem for vibrating in any direction.

1,249,841. Lighting Fixture. E. M. Smith, assignor to L. Plant and H. Plant, New York, N. Y. Semi-indirect type with reflecting surface on canopy.

1,249,846. Gasoline Cutout. L. H. Sparks, Lakewood, N. J., assignor of 49 per cent to J. I. Miller. Electromagnetically operated valve.

1,249,856. Current Tap. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Side receptacle in socket for receiving plug.

1,249,857. Electric Switch. G. B. Thomas, assignor to Bryant Electric Co. Toggle-lever-operated wall switch.

1,249,861. Generating and Lighting Device. H. R. Van Deventer, assignor to Splitdorf Electric Co., Newark, N. J. Tire driven generator and headlight for motorcycles, etc.

1,249,866. Electric Lead-In Fixture. A. F. Walther, Detroit, Mich. Service cross-arm and conduit leading under eaves into building. (See cut.)

1,249,872. Electrical Switch-Lock. P. W. Wiggert, Idagrove, Iowa. Combination lock for automobiles, etc.

1,249,881. Internal-Combustion Engine. J. A. Anglada, Brooklyn, N. Y. Special ignition arrangement for rotary gas engine.

1,249,898. Apparatus for Connecting Service Wires to Charged Main Wires. H. B. Bush, Redlands, Cal. Geared head on tool winds tap wire around main.

1,249,902. Railway Signaling System and Apparatus. C. J. Coleman, assignor to Hall Switch & Signal Co., New York, N. J. Alternating-current block signal system for electric railway.

1,249,909. Igniter for Internal-Combustion Engine. J. M. Dayton, assignor to Standard Co., Torrington, Conn. Make-and-break type.

1,249,953. Spark-Plug Tester. C. E. Harlan, Watsonville, Cal. Sparking points on roller.

1,249,954. Control System. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Energization of motor field upon temporary interruption of trolley current.

1,249,956. Signal Lamp for Vehicles. C. P. Hepler, Salem, O. Centrifugal device controlled by speed brings different colored plates before electric lamp.

1,249,962. Telephone Apparatus. L. L. Lundgren, assignor to P. E. Gordon and M. D. Paulin, Youngstown, O. Amplifying ear-piece for receiver.

1,249,965. Fuse and Circuit Tester. L. D. Johnson, Portland, Ore. Includes lamp and high-resistance coil in casing.

1,249,978. Incandescent Lamp. G. M. J. MacKay, assignor to General Electric Co., Schenectady, N. Y. Tungsten lamp contains some phosphorus pentoxide.

1,249,982. Machine for Subjecting Air to Certain Light Rays. E. M. Markel, Des Moines, Iowa. Electric fan blows air through passages around alternate edges of glass plates covered with powdered iron and connected to circuit like a condenser.

1,249,992. Circuit-Closer for Combination Locks and Burglar Alarms. M. D. Morton, Gauley Mills, W. Va. Circuit closed when lock is tampered.

1,250,002. Electric Mail-Carrier. F. E. Perkins, Baudette, Minn. Electric telphorage system.

1,250,009. Sparking Plug. T. E. Fouset, Paris, France. Provides cooling air current.

1,250,010. Electric Ice-Cutter. G. Pouchain, San Francisco, Cal., assignor of one-third each to C. W. Ayers and H. Gaytes. Electrically heated wires cut in to cubes.

1,250,015. Constant-Volume Governor. R. H. Rice, assignor to General Electric Co. For motor-driven Compressor.

1,250,030. Electric-Lamp Attachment. C. Schickerling, assignor to L. E. Schickerling, Weehawkin Heights, N. J. Headlight lamp bulb has top and rear blackened.

1,250,072. Process of Bleaching and Maturing Flour. J. N. Alsop, Owensboro, Ky. Subjected to mixture of chlorine, steam and air, the latter modified by an electric discharge.

1,250,080. Separable Attachment Plug. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. The body part includes cord-gripping means.

1,250,088. Process and Apparatus for Separation of Suspended Particles from Gases. H. A. Burns, assignor to International Precipitation Co., Los Angeles, Cal. Electric discharge causes gas convection toward absorbing liquid.

1,250,093. Stereoscopic X-Ray Apparatus. W. D. Coolidge, assignor to General Electric Co. Two sight holes are alternately opened and closed in synchronism with alternating current supplied.

1,250,105. Timer. C. R. Holmes, Montgomery, Mich. Rotary brush engages contact plugs.

1,250,116. Telephone-Exchange System. C. L. Goodrum, assignor to Western Electric Co. Automatic switches for interconnecting trunk circuits.

Reissue 14,406. Reflector. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co. For automobile headlight.

Financial News

WESTINGHOUSE ELECTRIC'S LARGE ORDERS.

Orders on the books of the Westinghouse Electric & Manufacturing Company are placed at $150,000,000, of which $52,000,000 is war business, including some large orders for shells. In view of the aggregate sales of the company in the last fiscal year, of $89,539,442 it is patent that something more than a year's business ahead is already placed. Recent monthly shipments of finished goods have been at the rate of approximately $7,500,000 per month, or at a rate of $90,000,000 per annum, which is very close to the figure for the year ended March 31 last. This figure for gross sales will have to be materially revised, however, for the rifle business of the company is not included, neither has the shell output of the company begun to figure in sales, as it will after the turn of the year. In the last fiscal year the Westinghouse Company earned $17,799,980 for the outstanding $70,813,950 common stock, each dollar of sales yielding close to 20 cents for the common stock. Earnings on the common amounted to $12.08 per share, in that period, against dividends of $3.25 per share. Westinghouse common at 35, today's quotation, is selling at less than half the price quoted in the bull market a year ago.

New Chicago Exchange Planned.

Brokers who deal in obscure stocks have announced a meeting to discuss the advisability of forming a new stock exchange in Chicago. The move is occasioned by the passage in the legislature of a new blue-sky law, which will become effective in Illinois the first of the coming year. The idea of the new exchange will be that obscure stocks, not exempted from the operations of the law, may secure immunity from state scrutiny by being listed there. The law exempts only securities listed upon exchanges approved by the secretary of the state, and, according to this provision, the new exchange must be acceptable to state authorities and the securities listed on it will be investigated by the state authorities.

Importance of Thrift Stamps.

George M. Reynolds, president of the Continental & Commercial National Bank, Chicago, in speaking recently of the value of thrift stamps said:

This new inducement to save—the thrift stamps—is of tremendous importance to all the people. We have been the most extravagant nation on earth, having grown so fast that we have overlooked the little things. Our interests have largely been in the biggest farms and factories, the longest railroads and rivers, the biggest buildings and bridges, and the broadest men and measures. The day of conservation, of taking care of the nickels and dimes, and of doing away with all forms of waste, is at hand. Now the extravagant shall become weak and the thrifty strong. Aside from the mere act of saving, patriotism should prompt every person to buy these thrift stamps and war savings stamps and certificates up to the limit of their capacity, or the limit that one person may hold under the law. They give every man, woman and child a chance to help supply the food, clothing and war materials that our brave soldiers must have if they are to carry the Stars and Stripes to that victory that will be won under the greatest galaxy of flags ever gathered together on any battlefield since time began.

West Virginia Traction and Electric.

West Virginia Traction and Electric Company has outstanding $1,800,000 of 6 per cent notes, secured by deposit of refunding bonds, and there are about $3,900,000 of underlying issues. The total interest charge is $305,483. There is also a rental charge of $10,000 and some other deductions. Net income in the year ended Feb. 28 last was $471,235, being about one and one-half times present fixed charges. As earnings have been increasing steadily, though not rapidly, this margin of safety makes interest reasonably secure. Recently the company obtained permission to increase its rates for gas.

Copper Prices 1850 to 1916.

United States Geological Survey, Washington, D. C., of which George Otis Smith is director, has issued a bulletin on the leading metals in California and Oregon, in which is given a table of general copper prices from 1850 to 1916, based upon averages of daily market prices current at New York, as follows:

Year.	Copper(b). Pound.	Year.	Copper(b). Pound.
1850	$0.22	1884	$0.13
1851	.166	1885	.108
1852	.22	1886	.111
1853	.22	1887	.138
1854	.22	1888	.168
1855	.27	1889	.135
1856	.27	1890	.156
1857	.25	1891	.128
1858	.23	1892	.116
1859	.22	1893	.108
1860	.23	1894	.095
1861	.22	1895	.107
1862	.22	1896	.108
1863	.34	1897	.12
1864	.47	1898	.124
1865	.392	1899	.171
1866	.342	1900	.166
1867	.254	1901	.167
1868	.23	1902	.122
1869	.242	1903	.137
1870	.212	1904	.128
1871	.241	1905	.156
1872	.356	1906	.193
1873	.280	1907	.20
1874	.220	1908	.132
1875	.227	1909	.13
1876	.21	1910	.127
1877	.19	1911	.125
1878	.166	1912	.165
1879	.186	1913	.155
1880	.214	1914	.133
1881	.182	1915	.175
1882	.191	1916	.246
1883	.165		

Weed, W. H., copper handbook, vol. 11, pp. 1339, 1343 for years 1850-1903. By computation from data for years 1850-1860, p. 1339. Survey computations for electrolytic copper since 1904. In 1916 sales prices all marketable grades.

Copper Production.

The production of copper from secondary sources in 1916, according to the revised Government report, was 700,000,000 pounds, of which nearly 117,000,000 pounds was recovered by plants refining primary metal. It is also significant that so-called secondary plants treated 741,000 tons of pig copper as well as 224 tons from alloys. It is believed that production of secondary copper this year, was as great if not greater than in 1916, and if so, the production of copper from all sources this year was about 3,200,000,000 pounds. Exports of copper this year are estimated at 490,000 tons, equivalent to 1,097,600,000 pounds. This is an increase of nearly 50 per cent as compared with 1916 exports, and a gain of approximately 28 per cent over the record-breaking foreign shipments in 1913. The supply of primary copper available this year—adding stocks on January 1 to refined production during the year—is estimated close to 2,600,000,000 pounds. After deducting estimated exports there would be left 1,500,000,000 pounds for domestic consumption, which is at the average rate of 125,000,000 pounds per month. This, of course, is based upon the assumption that stocks at the refineries at the close of this year will have been absorbed.

Public Utility Dividends.

Eastern Power & Light Corporation has passed the regular quarterly dividend of 1¾ per cent on the preferred stock. The directors decided that until conditions brought about by increases in wages and cost of materials change, the current surplus earnings of the property will be reinvested in required extensions and improvement.

Harrisburg Light & Power Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable December 31 to stock of record December 17, and has declared a dividend of 3½ per cent on the common stock.

Arkansas Light & Power Company declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable January 1 to stock of record December 15.

Dayton Power & Light Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable January 2 to stock of record December 20.

Duquesne Light Company declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable February 1 to stock of record January 1.

Wisconsin Edison Company declared a dividend of $1.50 a share, payable December 31 to stock of record December 21.

Bonbright & Company declared regular quarterly dividend of 1¾ per cent on the preferred stock, payable January 10 to stock of record December 31.

Colorado Springs Light, Heat & Power Company has declared regular quarterly dividend of 1½ per cent on the preferred stock, payable December 31 to stock of record December 17.

Georgia Light, Power & Railways declared regular quarterly dividend of 1½ per cent on the preferred stock, payable January 2 to stock of record December 31.

Manufacturers Light & Heat Company, Pittsburgh, declared the regular quarterly dividend of 2 per cent, payable January 15 to stock of record December 27.

Republic Railway & Light Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock, and a dividend of 1 per cent on the common stock, both payable January 15 to stock of record December 31.

South Carolina Light, Power & Railways Company declared a dividend of 1½ per cent on the preferred stock, payable January 2 to stock of record December 20.

Western Electric Company has declared the regular quarterly dividends of 1½ per cent on its preferred and 2 per cent on the common stock, payable December 31, to stock of record December 22.

Western Power Corporation declared regular quarterly dividend of 1 per cent on the preferred stock, payable January 15 to stock of record December 31.

National Conduit & Cable Company has passed its quarterly dividend. Disbursements were started last May with an initial declaration of $1 a share, and a similar payment was made in September.

Electric Securities Corporation, 2 per cent quarterly on the common and 1¼ per cent on the preferred stocks, the common payable December 31 to stock of record December 29 and the preferred payable February 1 to stock of record January 24.

Northern States Power Company, 1¾ per cent quarterly, each on the preferred and common stocks, the preferred payable January 15 and the common January 20 to stockholders of record on December 31.

Kellogg Switchboard Earnings.

Business in the Kellogg Switchboard & Supply Company for the current year makes a favorable showing as compared with the previous years. The percentage of increase for 1917 over 1916 is placed at 53 per cent, and for the first eleven

months of the year at 30 per cent. Despite the fact the company is enjoying the best year in its history the stock has declined steadily for several months on the Chicago curb. Last March Kellogg was as high as 320 and recently the price was 145 bid with 150 asked. A week ago the price was 20 points higher. Not only have earnings for the first eleven months of 1917 been at record levels, but unfilled orders at the end of November were $1,465,644, compared with $857,304 a year ago and $706,130 in 1915. November earnings of $503,981 were $174,574 greater than in the corresponding period of 1916. For eleven months gross earnings were $4,826,193, compared with $4,124,265 for the full year of 1916 and $3,734,436 in eleven months.

Cities Service Company November Earnings.

Even though large reserves have been created to provide for the estimated excess profits taxes, the earnings of Cities Service Company continue to expand at a remarkable rate. The earnings for the month of November were the largest reported this year, with the single exception of January. The gross earnings for last month amounted to $1,732,413, as compared with $1,328,389 in November, 1916, an increase of $404,024, or more than 30 per cent. The gross earnings for the 12 months ending November 30, 1917, were $19,110,629, an increase of $10,038,910, or 111 per cent. After deducting expenses, interest charges, and preferred stock dividends, there remained a balance for common stock and reserves of $15,102,348, an increase of $8,829,860, or 141 per cent. This is equal to $61.09 on each share of common outstanding, compared with $33.08 last year. The preferred stock dividends were earned 5.13 times compared with 3.77 times. The total surplus and reserves were $22,597,907, and the earnings available for reinvestment in the properties were $27,056,138, $1,247,682 being added during the month.

STATEMENT NOVEMBER 30, 1917.

	12 months Ending Nov. 30, 1917	12 Months Ending Nov. 30, 1916
Gross Earnings	$19,110,628.52	$9,071,718.81
Expenses	347,280.75	236,868.75
Net earnings	18,763,347.77	8,834,850.06
Interest on Notes and Debentures	2,948.58	299,479.63
Net to Stock	18,760,399.19	8,535,370.43
Divs. Pfd. Stk.	3,658,051.15	2,262,882.92
Net to Common Stock and Reserves	15,102,348.04	6,272,487.51
	Month of Nov., 1917	Month of Nov., 1916
Gross Earnings	$1,732,412.56	$1,328,388.75
Expenses	30,050.53	20,021.01
Net Earnings	1,702,362.03	1,308,367.74
Interest on Notes and Debentures	208.97	244.20
Net to Stock	1,702,153.06	1,308,123.54
Divs. Pfd. Stk.	327,585.00	274,368.00
Net to Common Stk. and Reserves	1,374,568.06	1,033,755.54
Contingent Fund		$ 795,459.02
Surplus Reserve		3,222,001.30
Stock Surplus		4,819,695.50
Surplus		13,760,750.73
Total Surplus & Reserve		22,597,906.55
Number of times Preferred dividend was earned	5.13	3.77
Per cent earned on average amount of Common Stock outstanding	61.09 per cent	33.08 per cent
Preferred Stock Outstanding		69,301,450.36
In hands of Public	66,467,052.11	
Owned by Public	2,834,398.25	
Common Stock Outstanding		32,122,464.00
In hands of Public	25,538,489.82	
Owned by Company	6,583,974.18	

Reports of Earnings.

DETROIT EDISON COMPANY.
(Including all Subsidiaries)

	1917	1916
November gross	$ 1,156,068	$ 993,087
Net	337,866	395,533
Surplus after charges	249,371	304,651
Eleven months' gross	10,983,739	8,954,353
Net	3,250,385	3,310,104
Surplus after charges	2,309,198	2,324,199

NEW ENGLAND COMPANY POWER SYSTEM.

	1917	1916
October gross	$ 257,796	$ 179,343
Net after taxes	100,523	109,645
Surplus after charges	49,976	58,939
Ten months' gross.	2,127,154	1,661,273
Net after taxes	940,525	1,044,759
Surplus after charges	441,626	544,386

LAKE SHORE ELECTRIC RAILWAY SYSTEM.

	1917	1916
October gross	$ 142,840	$ 136,113
Net after taxes	34,845	51,235
Deficit after charges	476	*14,714
Ten months' gross.	1,475,625	1,343,126
Net after taxes	476,207	505,119
Surplus after charges	129,359	141,292

*Surplus.

PHILADELPHIA RAPID TRANSIT COMPANY.

	1917	1916
November gross	$ 2,512,229	$ 2,361,936
Net after expenses.	1,016,219	1,040,537
Surplus after charges	205,463	226,363
Five months' gross	12,408,029	11,369,858
Net after expenses	5,173,430	5,062,132
Surplus after charges	1,116,849	988,819

PHILADELPHIA COMPANY.
Electric Light and Power Department.

	1917	1916
October gross	$ 900,829	$ 572,327
Net	188,899	228,312
Seven months' gross	5,199,536	3,737,352
Net	1,418,318	1,618,443
Total All Departments:		
October gross	3,172,585	2,409,258
Net	891,181	916,388
Seven months' gross	20,438,204	16,286,310
Net	7,219,055	6,641,007

CITIES SERVICE COMPANY.

For November—	1917	1916
Gross earnings	$ 1,732,412	$ 1,328,389
Net earnings	1,702,362	1,308,368
Balance for dividends	1,702,153	1,308,124
For twelve months ended November 30—		
Gross earnings	$19,110,629	$ 9,071,719
Net earnings	18,763,348	8,834,850
Balance for dividends	18,760,399	8,535,370

COLUMBIA GAS & ELECTRIC COMPANY.

For November—		Increase.
Gross earnings	$ 1,022,230	$ 197,906
Net operating earnings	519,787	120,629
Other income	163,937	111,450
Total income	678,724	232,079
Surplus	328,620	228,006
For the eleven months ending November 30—		
Total net and other income	$ 6,661,956	$ 2,134,868
Surplus	2,808,650	2,808,662

CHICAGO TELEPHONE COMPANY.

For November—	1917	1916
Number of company stations in service at end of month	550,700	554,985
Tel. opera. revenues	$1,805,985.67	$1,702,021.95
Net oper. income.	256,246.61	383,425.97

NEW YORK TELEPHONE.

For October—	1917	Increase.
Gross oper. revenue	$ 1,195,634	$ 367,392
Operating income	1,320,348	(a)199,678
From. Jan. 1 to Oct. 31:		
Gross operating revenue	$50,369,351	55,351,536
Operating income	14,393,847	325,119

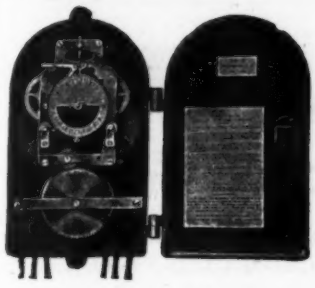
(a) Decrease.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Dec. 18.	Bid. Dec. 26.
Adirondack Electric Power of Glens Falls, common	..	13	15
Adirondack Electric Power of Glens Falls, preferred	6	70	68
American Gas & Electric of New York, common	10+extra	85	87
American Gas & Electric of New York, preferred	6	39	39¼
American Light & Traction of New York, common	..	190	190
American Light & Traction of New York, preferred	6	85	87
American Power & Light of New York, common	4	45	40
American Power & Light of New York, preferred	6	50	71
American Public Utilities of Grand Rapids, common	..	25	..
American Public Utilities of Grand Rapids, preferred	6	56	..
American Telephone & Telegraph of New York	..	97	99
American Water Works & Elec. of New York, common	..	4¼	4½
American Water Works & Elec. of New York, particip	7	8	8
American Water Works & Elec. of New York, first preferred	..	58	57
Appalachian Power of Bluefield, common	..	2	2½
Appalachian Power of Bluefield, preferred	7	25	18
Cities Service of New York, common	+extra	202	203
Cities Service of New York, preferred	6	68½	66¾
Commonwealth Edison of Chicago	8	103	100¼
Comm. Power, Railway & Light of Jackson, common	4	32	..
Comm. Power, Railway & Light of Jackson, preferred	6	63	..
Federal Light & Traction of New York, common	..	5	3
Federal Light & Traction of New York, preferred	..	25	25
Illinois Northern Utilities of Dixon	6	75	..
Middle West Utilities of Chicago, common	2+extra	24	19
Middle West Utilities of Chicago, preferred	6	56	55
Northern States Power of Chicago, common	ex.div. 7	68	..
Northern States Power of Chicago, preferred	ex.div. 7	87	86½
Pacific Gas & Electric of San Francisco, common	5	31½	30½
Pacific Gas & Electric of San Francisco, preferred	6	80	79
Public Service of Northern Illinois, Chicago, common	7	73	71
Public Service of Northern Illinois, Chicago, preferred	6	88	85
Republic Railway & Light of Youngstown, common	4	18	19
Republic Railway & Light of Youngstown, preferred	6	52	52
Standard Gas & Electric of Chicago, common	..	5	5½
Standard Gas & Electric of Chicago, preferred	6	19	19
Tennessee Railway, Light & Power of Chattanooga, common	..	2	2¼
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	10½
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	58	58
Western Power of San Francisco, common	..	7	7
Western Power of San Francisco, preferred	6	40	40
Western Union Telegraph of New York	extra	78	80
Industrials—			
Electric Storage of Philadelphia, common	4	47	44½
General Electric of Schenectady	8	119	..
National Carbon of Cleveland, common	8	56¼	56½
National Carbon of Cleveland, preferred	..	130¾	130⅝
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	34½	36⅝
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	57	58

*Last sale.



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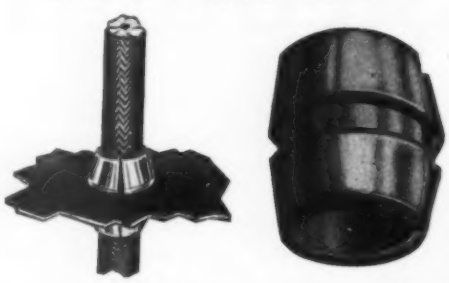

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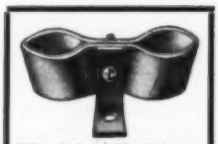

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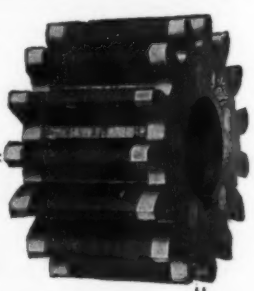

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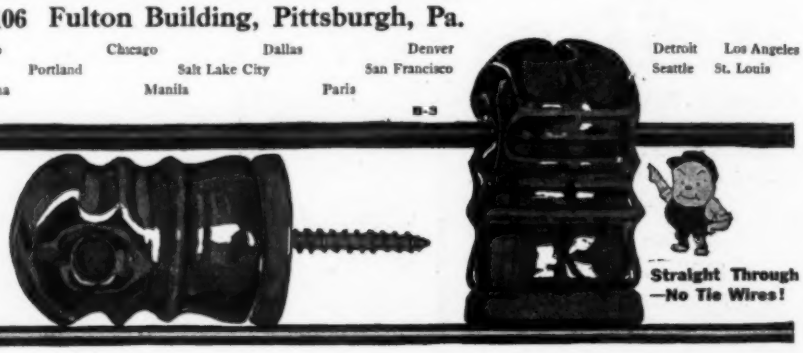

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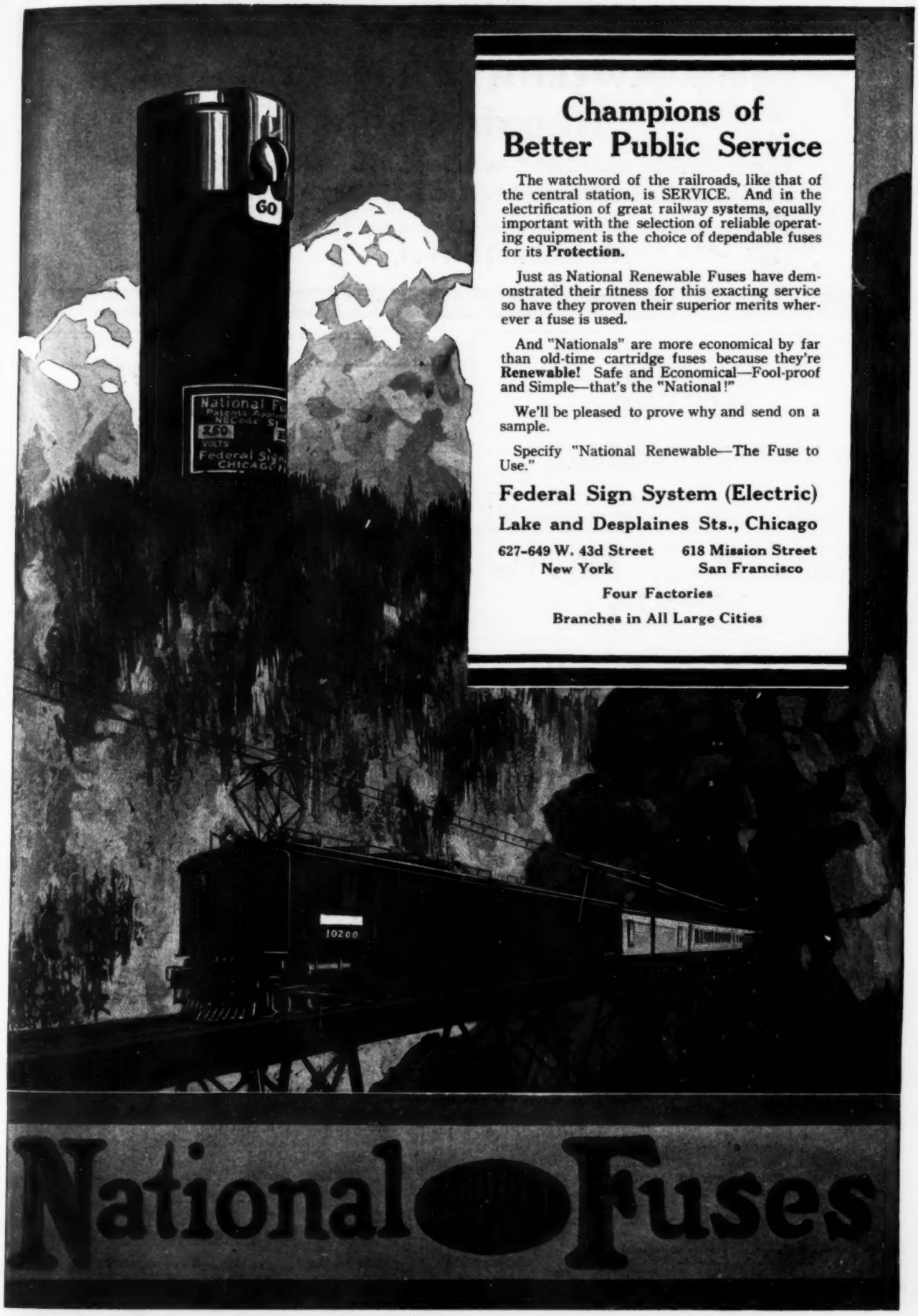

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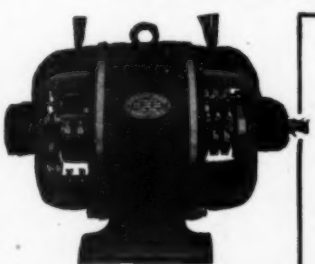

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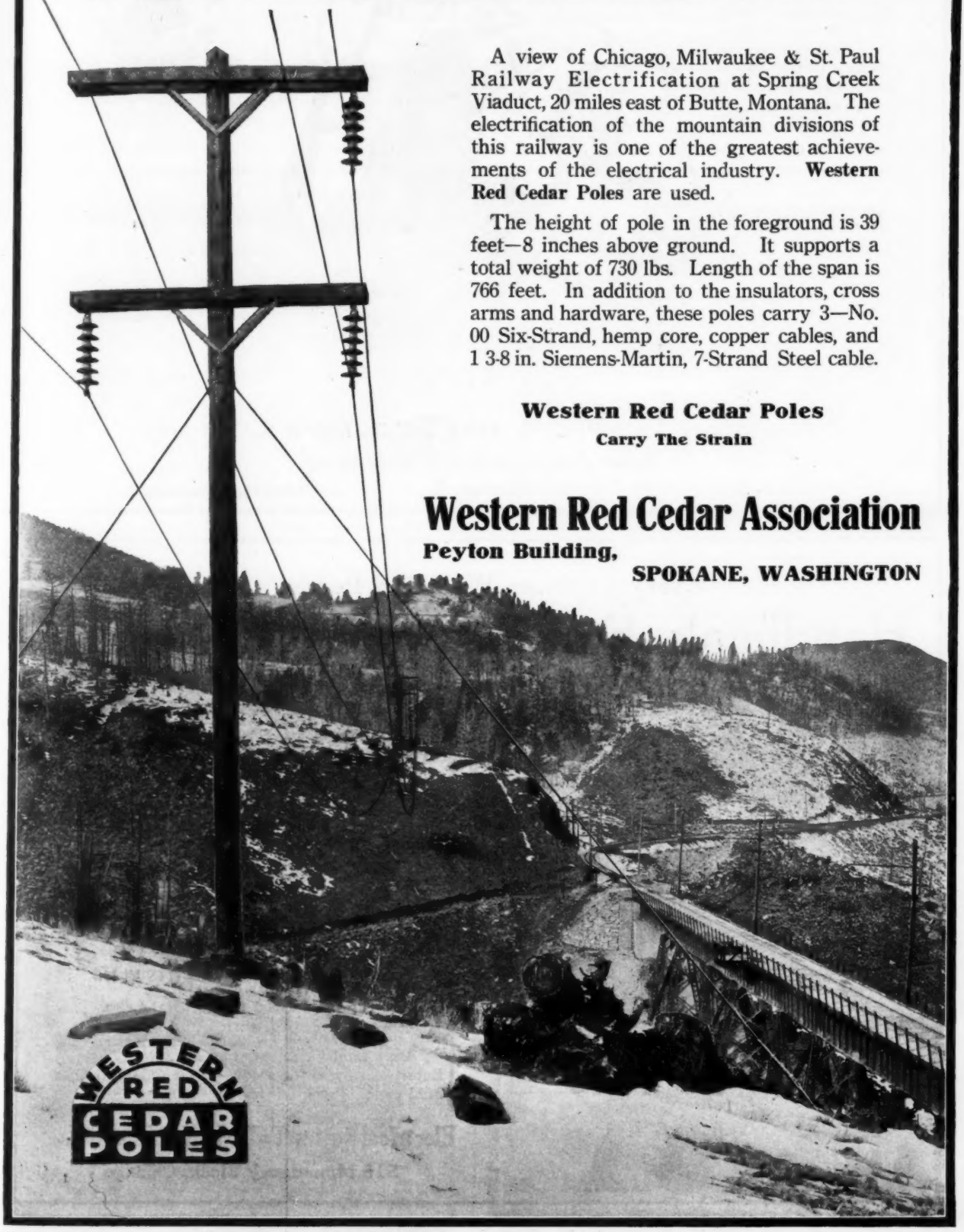

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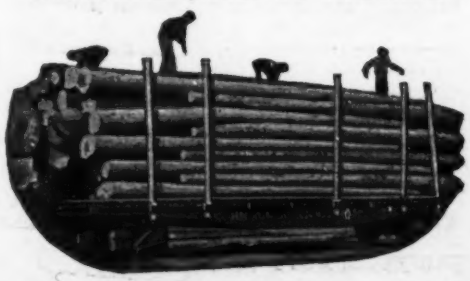
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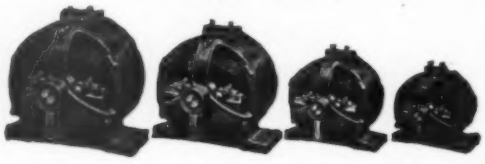

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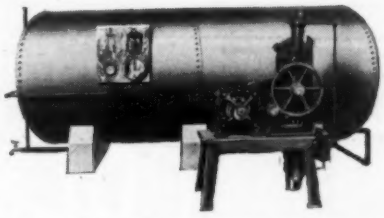

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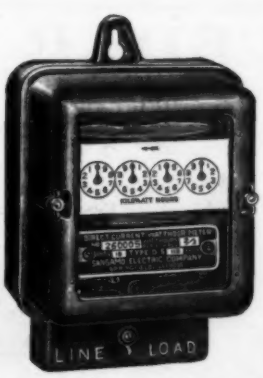

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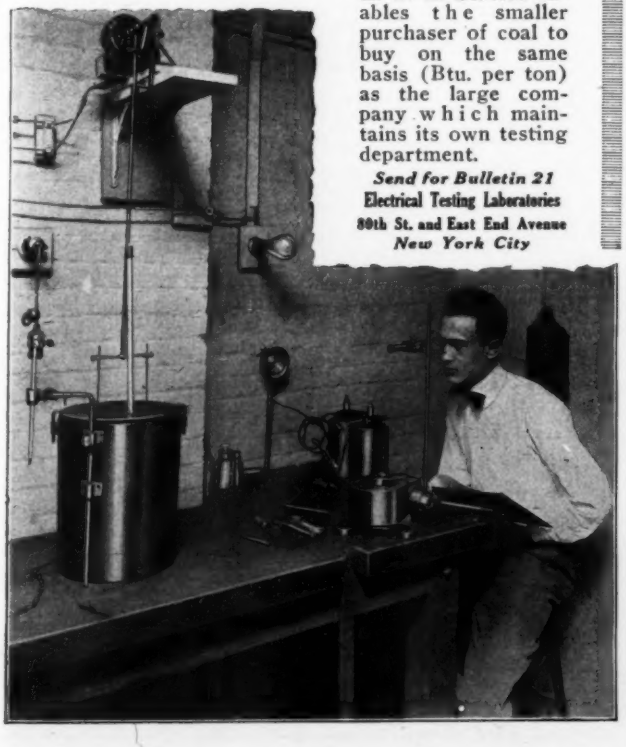

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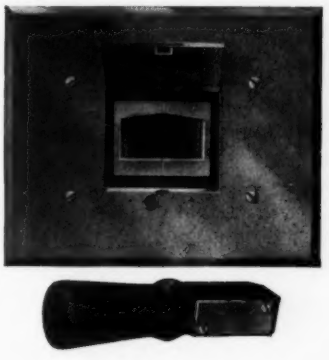

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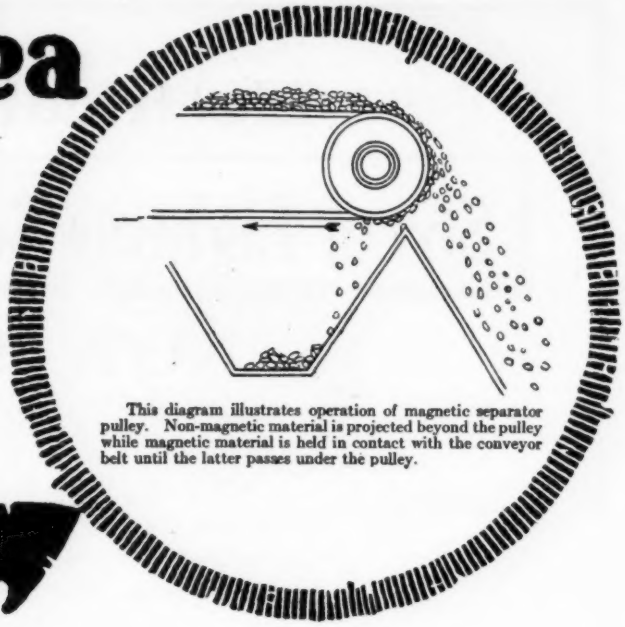
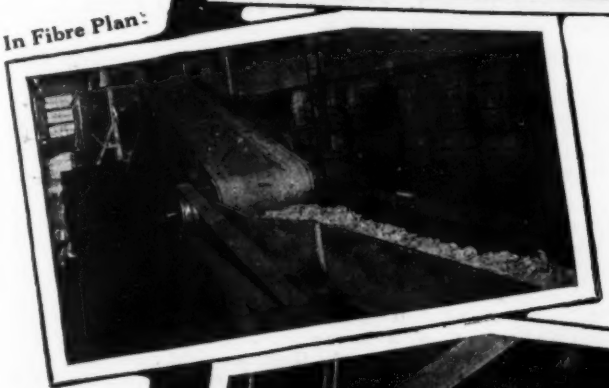


This diagram illustrates operation of magnetic separator pulley. Non-magnetic material is projected beyond the pulley while magnetic material is held in contact with the conveyor belt until the latter passes under the pulley.

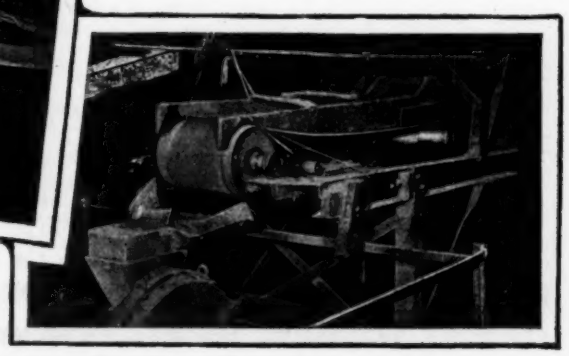
In Brass Plant

In Fibre Plant



In City Sewage Disposal Plant

In Cocoanut Crushing Factory



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are shown in a few typical uses in the accompanying illustrations. Many others as well as a complete description will be found in the new descriptive Booklet 8.

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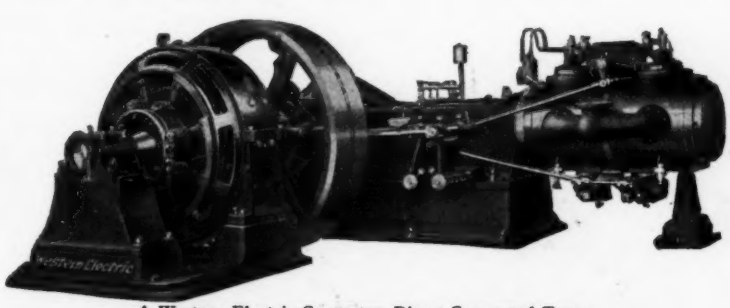

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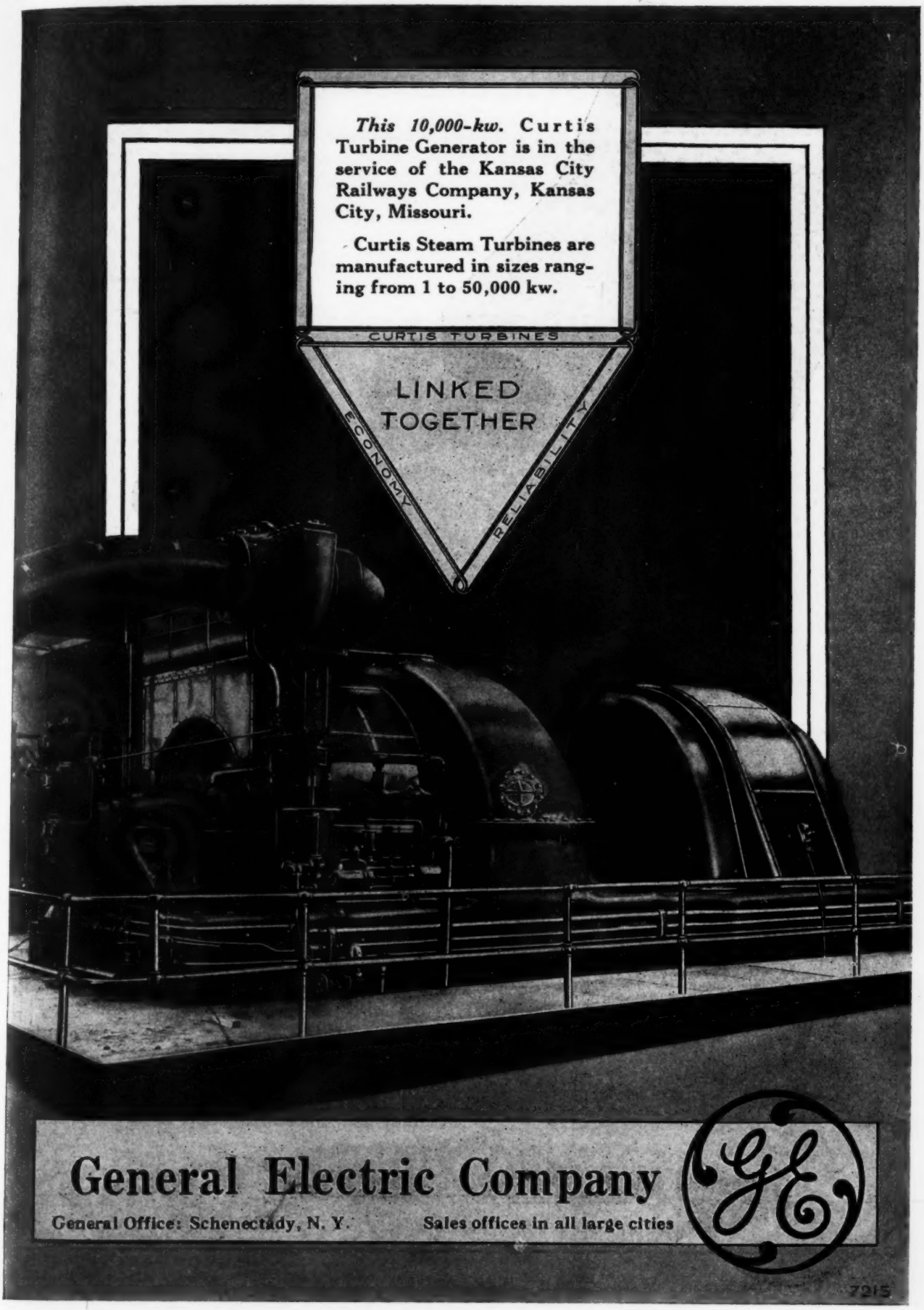
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1	1	G.E.	220	CR	525/1050
1	1½	G.E.	500	CR	525/1500
1	3	G.E.	220	RLC	600/1200
1	3½	Burke	220		935/1600
3	4	Northern	220		387/857
1	4	Westgh.	220	SA	400/1600
1	4½	G.E.	220	RLC	600/1200
1	5	Stow	110		700/1575
5	5	Northern	220		500/1000
1	5	G.E.NEW	230	BG	550/1650
1	7½	G.E.	500	CR	450/900
1	15	Reliance	110		550/1100
1	25	G.E.NEW	230	BR	400/800
1	35	Thompson-Ryan	230		300/800

3-PHASE, 60-CYCLE MOTORS

2	½	G.E.NEW	110	KT	1800
1	1	Fbks.-M.	440	B	1200
2	2	R.&M.NEW	220		1750
1	2	Wstg.	440	CS	1120
2	3	R.&M.NEW	220		1150
1	3	Cr.-Wh.	220		1720
1	3	Fbks.-M.	220	B	1200
3	5	G.E.NEW	220	KT	1800
4	5	G.E.NEW	220	KT	1200
3	5	G.E.NEW	220	KT	1200
1	7½-15	Cr.-Wh.	220/440		865/1735
5	7½	G.E.NEW	220	KT	1800
4	7½	G.E.NEW	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW	220	KT	900
1	10	Cr.-Wh.	550	Q	1800
4	15	R.&M.	220		1150
4	15	Fbks.-M.	220/440	KBV	1200
1	20	Cr.-Wh.	220/440		1200
1	20	Triumph	220/440		850
1	20	Fbks.-M.	220	B	1200
100	20	Fbks.-M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1160
1	25	G.E.	220	M	900
30	25	Wagner	220/440	BP	1120
4	30	Wagner NEW.	220		850
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
3	35	Triumph	220/440		900
1	40	Wagner NEW.	220/440	BP	850
2	40	G.E.NEW	220	KT	1200
2	40	Fbks.-M.	220		900
1	50	Triumph	220		720
1	50	G.E.	220	M	900
1	50	G.E.NEW	220	KT	900
2	50	G.E.NEW	440	KT	900
1	50	G.E.NEW	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	220	L	600
1	150	Westgh. NEW.	440	CW	695
1	200	Wstg.	2200	CCL	580
1	263	G.E. Synchronous with direct connected exciter	2200		600

3-PHASE, 25-CYCLE MOTORS

1	5	G.E.	220	KT	750
1	12½	G.E., elev. type, high torque	220	KTE	750
1	15	Westg.	440	CS	730
1	15	Fbks.-M.	440	B	750
6	20	Allis-Ch.	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch., intermittent duty, sl. rg. drum controller	440		500
1	55	Wstg.,sl.rg.30 cycles,complete	440		860
1	60, 45, 30	G.E.	440		500/375/250

2-PHASE, 60-CYCLE MOTORS

2	1	Westg.	220	CCL	1700
4	2	R.&M.NEW	220		1750
6	3	R.&M.	220		1750
3	5	Wstg.NEW	220	KQ	1800
1	5	Wstg.NEW	220	CS	1130
4	5	G.E.NEW	220	KQ	1200
3	5	R.&M.NEW	220		1700
1	7½	G.E.	220	IQ	900
7	7½	G.E.NEW	220	KQ	1200
1	7½	Northwestern	220		1145
1	7½	R.&M.NEW	220		1150
1	10	G.E.	220	IQ	900
1	10	R.&M.NEW	220		1750
1	10	R.&M.NEW	220		1150
1	10	G.E.NEW	220	KQ	1200
1	15	Wagner	220	BW	1140
4	20	G.E.NEW	220	KQ	1200
2	20	G.E.	220	IQ	900
1	25	G.E.	220	IQ	1200
2	25	Wagner	220	BW	1140
1	30	G.E.NEW	220	KQ	1200
1	40	G.E.NEW	220	KQ	1200
1	40	Wstgh.NEW	220	CS	1170
1	40	Wagner NEW	220	B	850
2	50	Wagner NEW.	220	B	850

TRANSFORMERS—Single Phase

Qu.	Kw.	Make.	Cy.	Type.	Voltage.
2	6/10	G.E.	60		1200-2400/120-240
1	1	G.E.	60	H	1040/52-104
1	1	G.E.	60	H	127-110
1	1	G.E.	60		500-200
1	5	Pitts.	60		1500-3000/110
2	7½	G.E.	60	H	1040-2080/104-208
1	8	Am.	60		500-200
1	10	G.E.	60	H	1040-2080/52-104
5	10	G.E.	60	H	1040-2080x104-208
4	15	G.E.	60	H	1040-2080/104-208
7	5	Wstg.	60	ST	2100-2200x220-440
1	20	G.E.	60	H	1040-2080x104-208
1	25	Wstg.	60	OD	13200x110-220
1	25	G.E.	60	HE	1040-2080x104-208
1	25	G.E.	60	H	1040-2080x104-208
3	75	Wstg.	60	SK	13000/2400
2	100	Wstg.water cooled			11000-2500
2	100	G.E.	60		6600/6000x2300-1150
2	110	Wstg.	60	OISC	2200x180-360
6	200	Wstg.	29	OISC	22000x410
1	250	Wstg.	60	OISC	13200x220-440
2	300	Bullock	60		6600-2200

Three Phase

3	5	Wstg.	60	ST	2100-2200x220-440
4	5	G.E.	60	HT	2080Yx230-460
1	7½	Wstg.	60	ST	2200/2100x220-440
1	7½	G.E.	60	HT	2080Yx230-460
2	15	Wstg.	60	ST	2100-2200x220-440
2	30	G.E.	60	HT	2080Yx230-460

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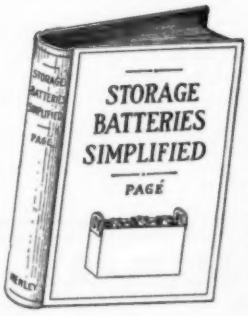

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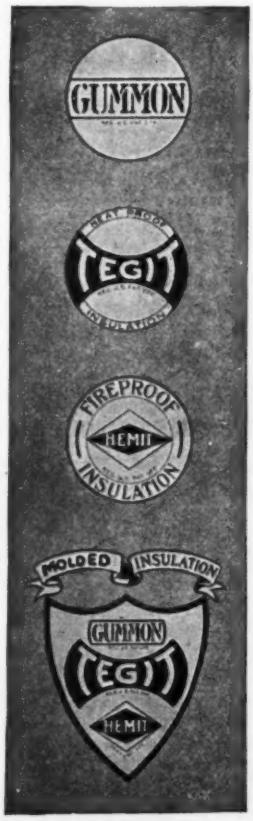

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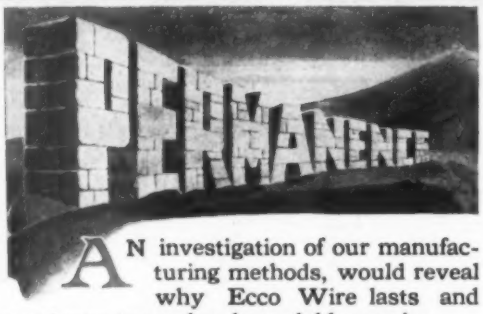

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Sundh Electric Co.
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STANDARD CELLS.
Leeds & Northrup Co.
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STATIONS, Coaling.
American Bridge Co.
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STATIONS, Elevated Ramway.
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STEEL, Structural and Tool.
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STOVES, Electric.
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Westinghouse Elec. & Mfg. Co.

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General Electric Co.

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Delta-Star Electric Co.
General Electric Co.
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Pittsburgh Transformer Co.

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Electric Controller & Mfg. Co.
Electrical Testing Laboratories.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Metropolitan Engineering Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
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SWITCHBOARD SLATE.
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American Bridge Co.

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Mica Insulator Co.
New York Insulated Wire Co.
Okonite Co., The.
Standard Paint Co.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Manhattan Electrical Supply Co.

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Manhattan Electrical Supply Co.
Western Electric Co.

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Mueller & Co., R. S.

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Electrical Testing Laboratories, Inc.
Underwriters' Laboratories.
V. & D. Electric Co.

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Bleadon-Dun Co.

THERMOMETERS, Electric.
Leeds & Northrup.

TIES, Pressed Steel.
American Bridge Co.

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Wrigley Co., Thomas.

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General Electric Co.
Hasard Mfg. Co.
Hubbard & Co.
Safety Ins. Wire & Cable Co.

TOOLS, Commutator Truing.
General Electric Co.
General Electric Co., Ft. Wayne Dept.

TOOLS, Linemen's.
Central Electric Co.
Hubbard & Co.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Schweitzer & Conrad, Inc.
Smith & Hemenway Co., Inc.

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General Electric Co.
General Electric Co., Ft. Wayne Dept.
Robbins & Myers Co.
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McGill Mfg. Co.

TOWERS, Electric Transmission.
American Bridge Co.

TOWERS, Steel Transmission.
American Bridge Co.

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General Electric Co.
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American Bridge Co.

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Allis-Chalmers Mfg. Co.

TURBINES, Water.
Allis-Chalmers Mfg. Co.

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Crystal Machine Co.
Federal Sign System (Electric).
Geyser Electric Co.
Home Specialty Mfg. Co.
Hurley Machine Co.
Meadows Mfg. Co.
Western Electric Co.

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General Electric Co.
General Electric Co., Ft. Wayne Dept.
Roller-Smith Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.

WINDERS, Electro-Magnet.
Belden Mfg. Co.
Hubbard & Co.

WINDLASSES, Arc Lamps.
Brady Electric Mfg. Co.
Cutter Co., George.
Hubbard & Co.

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Belden Mfg. Co.

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Atlantic Insulated Wire & Cable Co.
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Collyer Insulated Wire Co.
General Electric Co.
Hasard Mfg. Co.
Indiana Rubber & Insulated Wire Co.
Lowell Insulated Wire Co.
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National Conduit & Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Wire Co.
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Safety Insulated Wire & Cable Co.
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Standard Underground Cable Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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Belden Mfg. Co.
Moore, Alfred F.
Roebling's Sons Co., John A.
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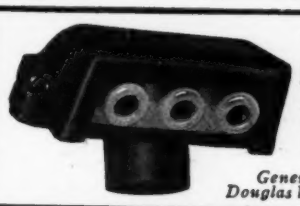
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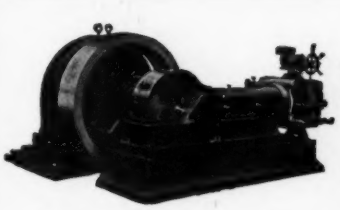
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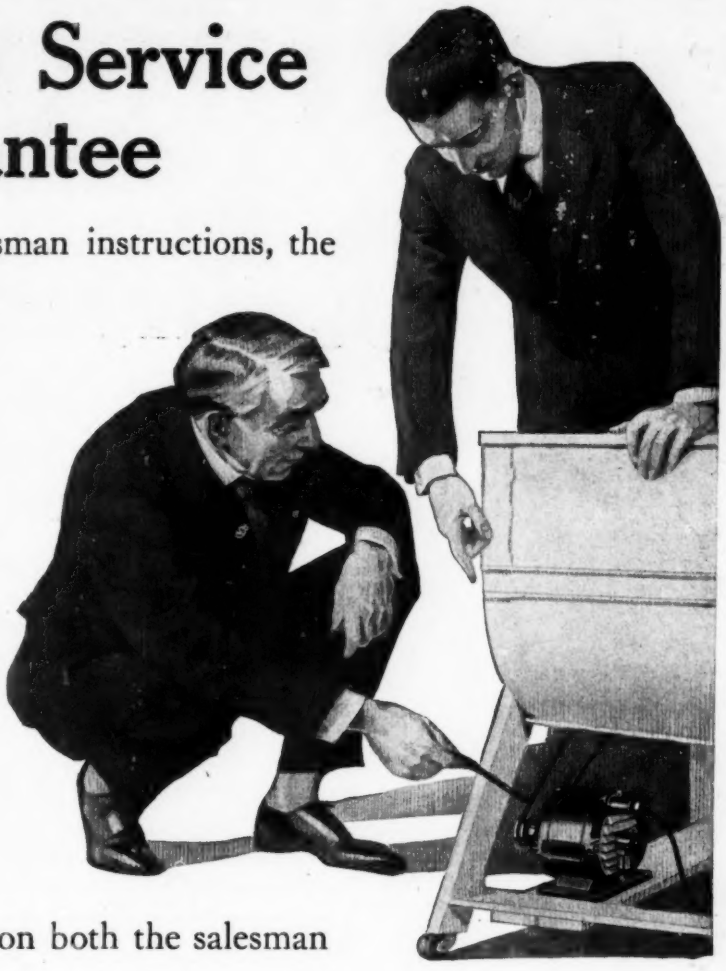

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The dealer recognizes the Robbins & Myers Motor as a built-in service guarantee, and realizes the importance of having every salesman point out the motor to prospects who are considering an electric-driven machine which is R.&M. equipped.

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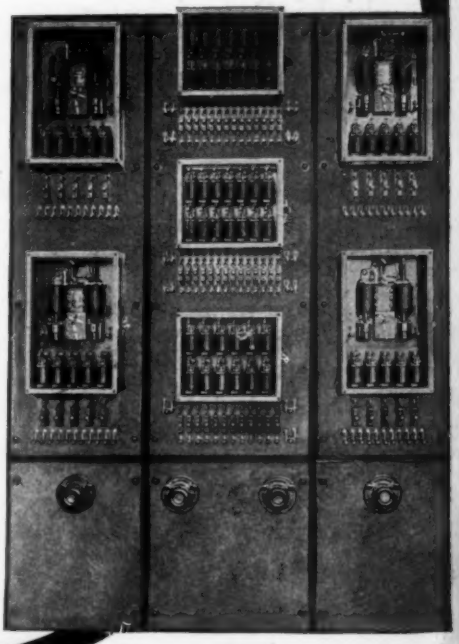

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